ACCIDENT REPORT

Report on the investigation of

the fire on board

# *Celtic Carrier*

24 miles west of Cape Trafalgar, Spain

on 26 April 2013

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

SERIOUS MARINE CASUALTY REPORT NO 18/2014 JULY 2014

**Extract from**

**The United Kingdom Merchant Shipping**

**(Accident Reporting and Investigation)**

**Regulations 2012 – Regulation 5:**

*"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."*

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.



All MAIB publications can be found on our website: www.maib.gov.uk

For all enquiries:
Marine Accident Investigation Branch
Mountbatten House
Grosvenor Square
Southampton
United Kingdom
SO15 2JU

Email: maib@dft.gsi.gov.uk
Telephone: +44 (0) 23 8039 5500
Fax: +44 (0) 23 8023 2459

# SECTION 1 CONTENTS

**FIGURES**



**TABLE**

**ANNEXES**

| | | |
|---|---|---|
| **Annex A** | **-** | Extracts from A Master's Guide to the UK Flag |
| **Annex B** | **-** | IMO Guidelines for the operational implementation of the ISM Code by companies |
| **Annex C** | **-** | IMO Guidance on near-miss reporting |
| **Annex D** | **-** | International Shipping Federation – safety culture leaflet |
| **Annex E** | **-** | MAIB Safety Digest 1/2007, case 15 |

# GLOSSARY OF ABBREVIATIONS AND ACRONYMS

| | | |
|---|---|---|
| 2/O | - | Second officer |
| AB | - | Able seaman |
| ACS | - | Alternative Compliance Scheme |
| BA | - | Breathing Apparatus |
| C | - | Celsius |
| C/O | - | Chief officer |
| C/E | - | Chief engineer |
| CEC | - | Certificate of Equivalent Competency |
| CFRA | - | Chief Fire and Rescue Adviser |
| CMW | - | Charles M. Willie & Co. (Shipping) Ltd |
| $CO_2$ | - | carbon dioxide |
| CoC | - | Certificate of Competency |
| COSWP | - | Code of Safe Working Practices for Merchant Seamen |
| DoC | - | Document of Compliance |
| DPA | - | Designated Person Ashore |
| EEBD | - | Emergency Escape Breathing Device |
| EPIRB | - | Emergency Position Indicating Radio Beacon |
| FRS | - | Fire and Rescue Service |
| GRA | - | generic risk assessment |
| gt | - | gross tonnage |
| ILO | - | International Labour Organization |
| IMO | - | International Maritime Organization |
| ISM Code | - | International Safety Management Code |
| ISPS Code | - | International Ship and Port Facility Security Code |
| kW | - | kilowatt |
| m | - | metre |

| | | |
|---|---|---|
| MCA | - | Maritime and Coastguard Agency |
| MEPC | - | Marine Environment Protection Committee |
| MGN | - | Marine Guidance Note |
| mm | - | millimetre |
| MoU | - | Memorandum of Understanding |
| MRCC | - | Maritime Rescue Co-ordination Centre |
| MSC | - | Maritime Safety Committee |
| NCN | - | Non-Conformity Note |
| OLB | - | Official Log Book |
| OS | - | Ordinary Seaman |
| PMoU | - | Paris Memorandum of Understanding |
| PSC | - | Port State Control |
| SMC | - | Safety Management Certificate |
| SMS | - | Safety Management System |
| SOLAS | - | International Convention for the Safety of Life at Sea 1974, as amended |
| STCW | - | International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended (STCW Convention) |

**Times:** All times used in this report are UTC+2 unless otherwise stated

# SYNOPSIS

At 0315 (UTC+2) on 26 April 2013, a fire broke out in a crew cabin on board the UK registered general cargo ship *Celtic Carrier.* The ship was on passage from Gibraltar to Belfast with a cargo of cement.

The crew member, in whose cabin the fire started, had been consuming alcohol and smoking cigarettes. He had continued to smoke after climbing into bed and had fallen asleep while holding a lit cigarette. It is probable that the lit cigarette then melted an adjacent sofa's vinyl covering and ignited the foam seating beneath.

The crew member awoke, discovered the fire, proceeded to the bridge and informed the second officer, who then sounded the fire alarm. The crew mustered and then attempted to contain and fight the fire. However, the fire was not finally brought under control until 1226, after two fire-fighting teams had transferred to the ship from a Spanish naval vessel. The fire was subsequently extinguished and *Celtic Carrier* was then towed to Cadiz, arriving at 0545 on 27 April. Three crew cabins were damaged by the fire, which had caused an electrical failure of the ship's steering gear, and the majority of the accommodation spaces were damaged by heat, smoke and water.

The investigation identified that *Celtic Carrier*'s crew were ill-prepared for the emergency; there was a lack of leadership, and sub-standard fire-fighting techniques resulted in crew members being unnecessarily exposed to danger. It was found that the official records of some emergency drills had been falsified, and that a complacent approach to safety existed on board.

The ship's owner, Charles M. Willie & Co. (Shipping) Ltd (CMW), was aware of a number of weaknesses relating to its safety management system (SMS) that needed to be addressed both ashore and afloat. However, the need to involve its crews in the application of the SMS to ensure its success was not fully recognised. The investigation also identified weaknesses in the Maritime and Coastguard Agency's (MCA) paper-based system for monitoring its International Safety Management (ISM) Code audit activity. The lack of a national database for ISM Code audits hampered the MCA's ability to conduct fleet performance trend analysis, and to ensure that a consistent approach to auditing was carried out.

CMW and the MCA have taken a range of actions in response to the fire on board *Celtic Carrier,* which should reduce the likelihood of a similar accident occurring in the future. In addition, the MAIB has made recommendations to CMW aimed at developing a robust safety culture both ashore and across its fleet. The MCA has been recommended to review its processes for managing the information gained from surveys, audits and inspections relating to the ISM Code.

# SECTION 1 - FACTUAL INFORMATION

## 1.1 PARTICULARS OF *CELTIC CARRIER* AND ACCIDENT

| **SHIP PARTICULARS** | |
|---|---|
| Vessel's name | *Celtic Carrier* |
| Flag | United Kingdom |
| Classification society | Lloyd's Register |
| IMO number | 8516287 |
| Type | General cargo |
| Registered owner | Charles M. Willie & Co. (Shipping) Ltd |
| Manager(s) | Charles M. Willie & Co. (Shipping) Ltd |
| Construction | Steel |
| Built | 1984, Hamburg |
| Length overall | 89.11m |
| Gross tonnage | 2565 |
| Minimum safe manning | 7: near-coastal;<br>8: international voyages |
| Authorised cargo | Bulk cargoes and containers |
| **VOYAGE PARTICULARS** | |
| Port of departure | Gibraltar |
| Port of arrival | Belfast |
| Type of voyage | International |
| Cargo information | Cement |
| Manning | 8 |
| **MARINE CASUALTY INFORMATION** | |
| Date and time | 26 April 2013 at 0315 |
| Type of marine casualty or incident | Serious Marine Casualty |
| Location of incident | 36° 05.8N 006° 32.0W. 24 miles west of Cape Trafalgar, Spain |
| Place on board | Deck 2 starboard aft accommodation |
| Injuries/fatalities | 1 injured crew member |
| Damage/environmental impact | Three crew cabins damaged by fire. Heat, smoke and water damage to the majority of the accommodation spaces |
| Ship operation | In passage |
| Voyage segment | Mid-water |

| | |
|---|---|
| External & internal environment | Good visibility<br>Force 2 wind<br>Slight sea<br>Air temperature 17°C |
| Persons on board | 8 |


*Celtic Carrier*

## 1.2 NARRATIVE

### 1.2.1 Events leading up to the fire

On 22 April 2013, *Celtic Carrier* sailed from Arzew, Algeria, bound for Belfast with a cargo of cement. At 0100 on 24 April the vessel stopped at Gibraltar to carry out repairs to a diesel generator and to take on bunkers. *Celtic Carrier* departed Gibraltar at 1830 on 25 April to resume passage to Belfast.

On 25 April, while alongside in Gibraltar, able seaman No 2 (AB2[1]) consumed several alcoholic drinks ashore before returning to the ship and having dinner at 1700. He assisted with the unmooring operation when *Celtic Carrier* sailed from Gibraltar, and then watched television alone in the crew mess room **(Figure 1)** until 2300 when he went to his cabin **(Figures 1** and **2)**.

At 2000, the master relieved the chief officer (C/O) for the bridge watch. At around 2200, the cook carried out a set of 'fire rounds' before going to bed. At 2400, the second officer (2/O) took over the bridge watch from the master, who proceeded to his cabin. None of these personnel noticed anything untoward as they passed through the accommodation. There were no bridge lookouts on duty.

### 1.2.2 Start of the fire

In his cabin, AB2 opened the porthole and then sat on the sofa **(Figure 3)** drinking beer and smoking cigarettes. He then closed his cabin door, got undressed, moved a glass ashtray from the cabin table to the sofa and climbed into bed. Sitting in bed with the reading light above his head switched on, AB2 continued to drink and smoke, reaching out with his right hand to use the ashtray, before eventually falling asleep.

At about 0315 on 26 April, AB2 awoke with a feeling of pain in his right hand and on the inside of his right leg. He saw flames and thick smoke coming from the sofa. He jumped out of bed and threw a blanket, which was on the sofa, at the fire. The blanket was already alight and, as AB2 threw it, a burning part of it touched the top of his head.

AB2 opened his cabin door and, still in his underwear, ran along the alleyway, through the open doorway of the forward stairwell, and up the stairs to the bridge **(Figure 1)**. He did not close his cabin door properly as he left.

### 1.2.3 Raising the alarm

At 0317, AB2 entered the bridge and shouted that there was a fire in his cabin. The 2/O descended the stairs to Deck 2 where the crew cabins were situated and saw smoke in the alleyway. He returned to the bridge and told AB2 to muster on the poop deck. He then sounded the fire alarm and stopped the main engine.

By 0320, no one had appeared on the bridge and, unwilling to re-enter the accommodation, the 2/O proceeded to the poop deck via the external stairs.

[1] According to the emergency muster list and hours of work and rest schedule

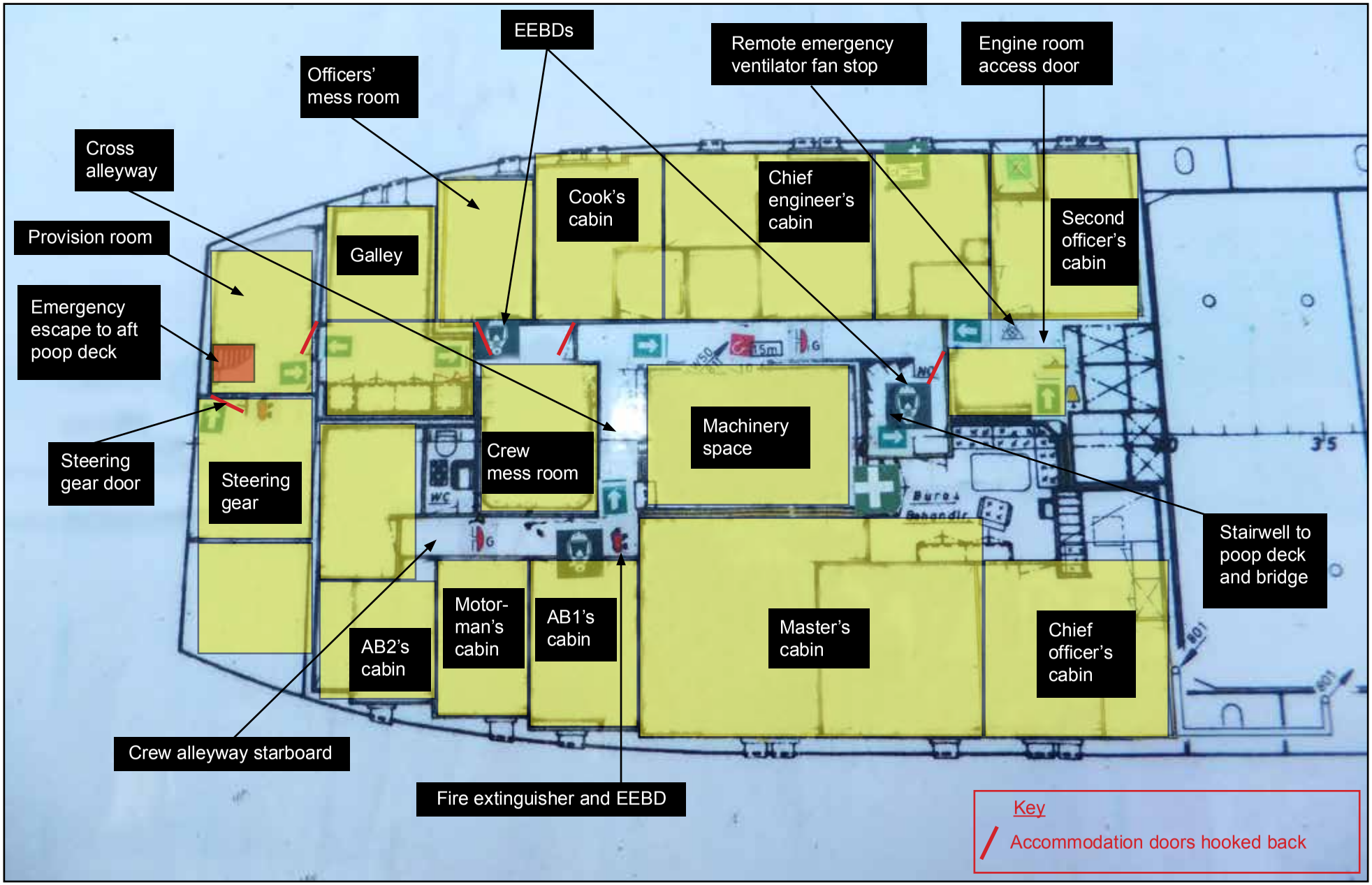



**Figure 1:** Deck 2 accommodation layout

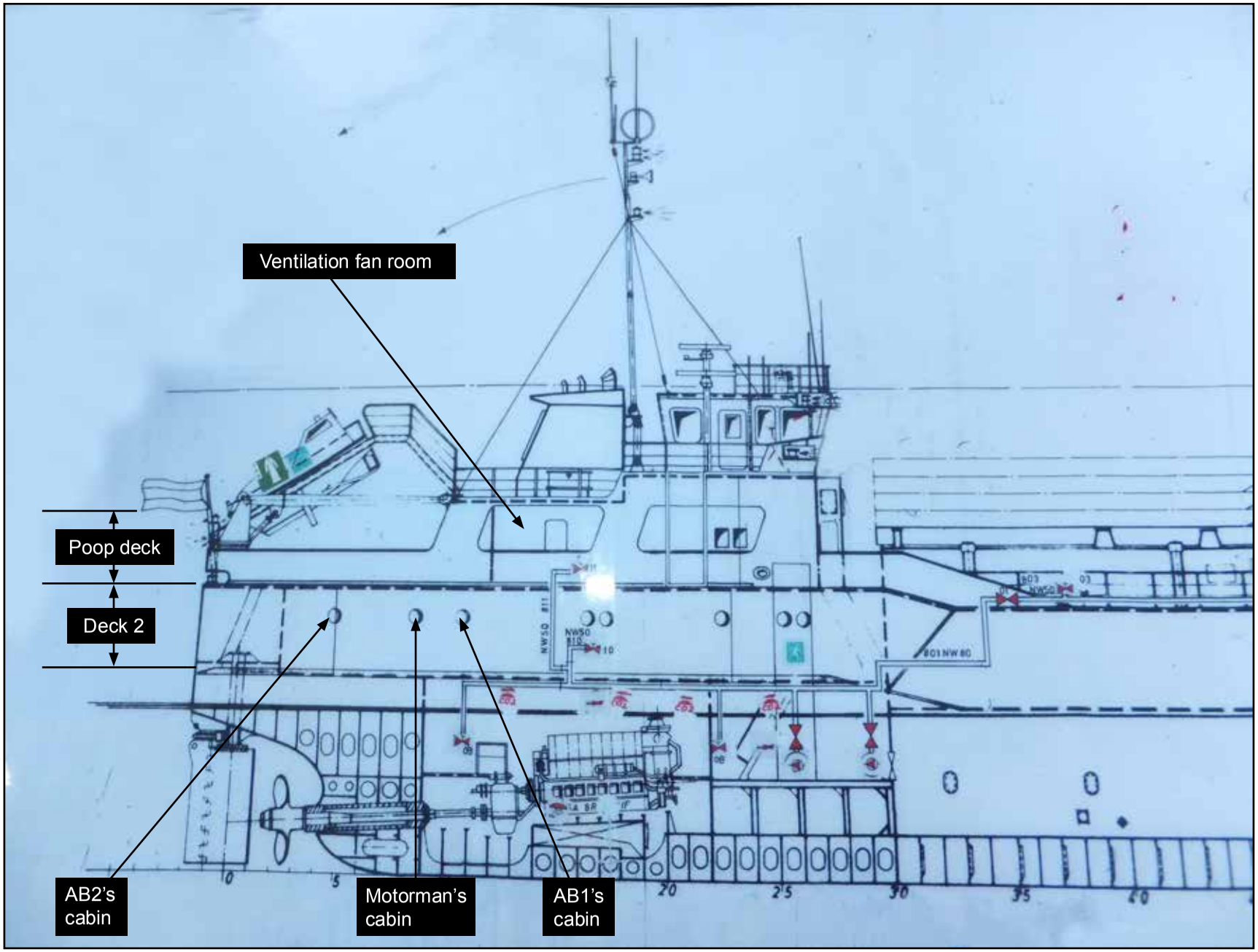



**Figure 2:** Vessel aft section profile

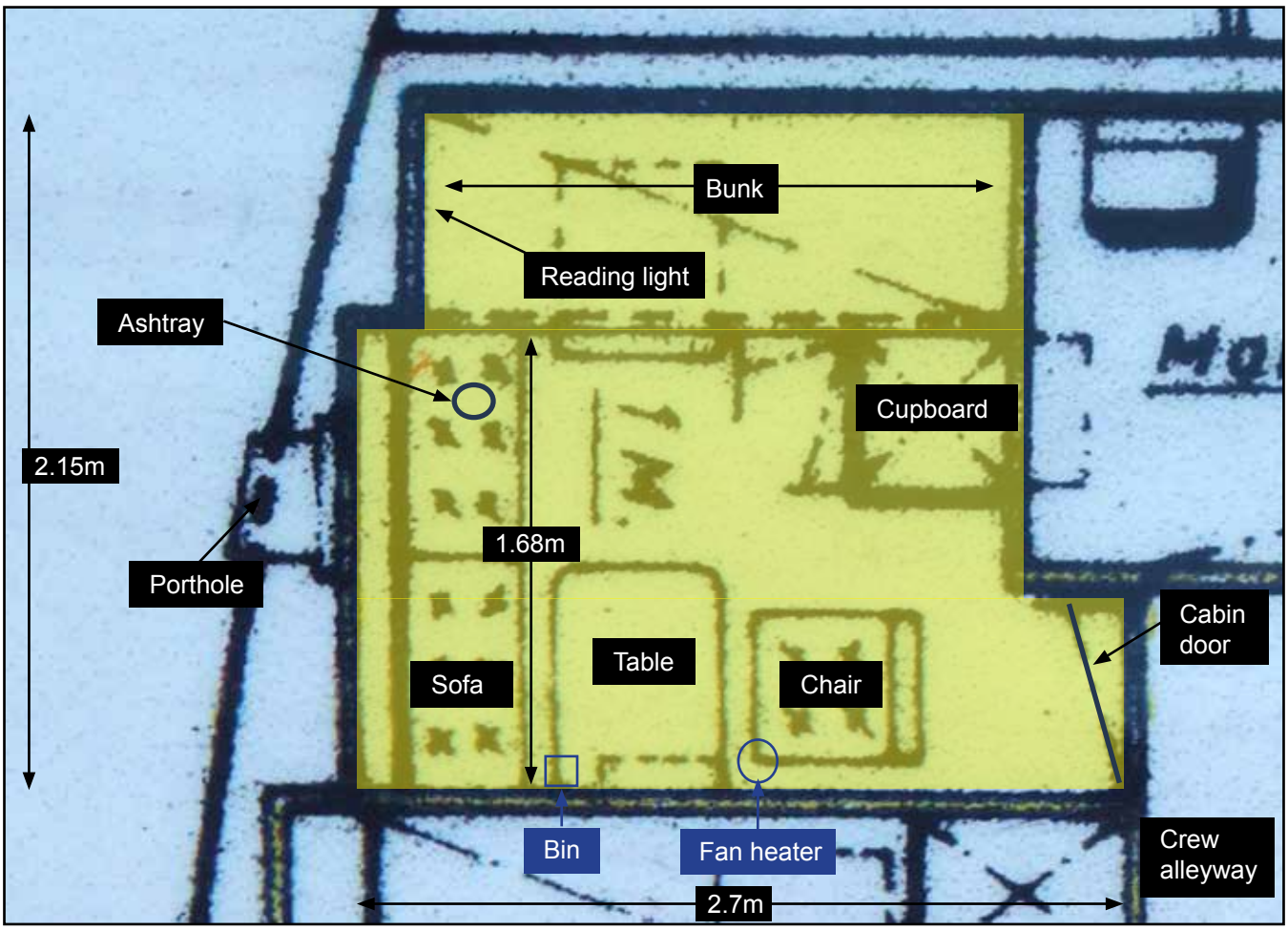



**Figure 3:** Layout of AB2's cabin

### 1.2.4 Crew response and escape

The motorman was woken by the fire alarm, and saw smoke in his cabin. Wearing a t-shirt and casual trousers, and with a rag over his face, he opened his cabin door, held his breath and ran barefoot along the alleyway and up the internal stairs to the poop deck, where he joined AB2 and the 2/O.

AB1 was woken by what he thought was the sound of a small explosion and the noise of electrical circuit breakers tripping open. He smelled burning plastic and then heard the fire alarm. In the darkness of his cabin, he got out of bed and opened his cabin door. The alleyway was dark and he sensed thick smoke. He closed the door, crossed the cabin and opened the porthole. Then, in his pyjama bottoms, AB1 climbed out of the porthole opening and pulled himself up the vessel's side and over the poop deck bulwark **(Figure 4)**.

The chief engineer (C/E) and cook, in their separate cabins, were woken by the fire alarm. They each opened their cabin door, found the alleyway full of smoke, and then closed the door and got dressed before making their way through the smoke to the poop deck. They used rags over their faces to protect themselves from the smoke. The C/O woke up and smelled smoke. He opened his cabin door and saw dense smoke in the alleyway. He heard an alarm, left his cabin and joined the crew on the poop deck.

**Figure 4:** Starboard side crew cabin portholes showing AB1's escape route

On being woken by the fire alarm, the master made his way up the internal stairs to the bridge, which he found unmanned. A crew member then came to the bridge and told him that there was a fire in the accommodation.

### 1.2.5 Fire-fighting

The crew ran out three fire hoses: two from the starboard side of the main deck and one from the port side of the poop deck. The fire hoses were initially directed to cool the starboard side of the poop deck and the ship's side in way of the crew cabins.

The C/E and motorman entered the engine control room via the emergency escape hatch on the forward port side of the poop deck **(Figure 5)**. The C/E stopped the accommodation ventilation fans, turned off the electrical power to the accommodation, and started the fire/ballast pump and emergency generator.

AB2, the cook and the motorman then closed the accommodation ventilation fire dampers while the 2/O collected a self-contained breathing apparatus (BA) set from the forecastle. The fire in AB2's cabin took hold rapidly, and flames and smoke were seen emanating from the cabin's porthole.

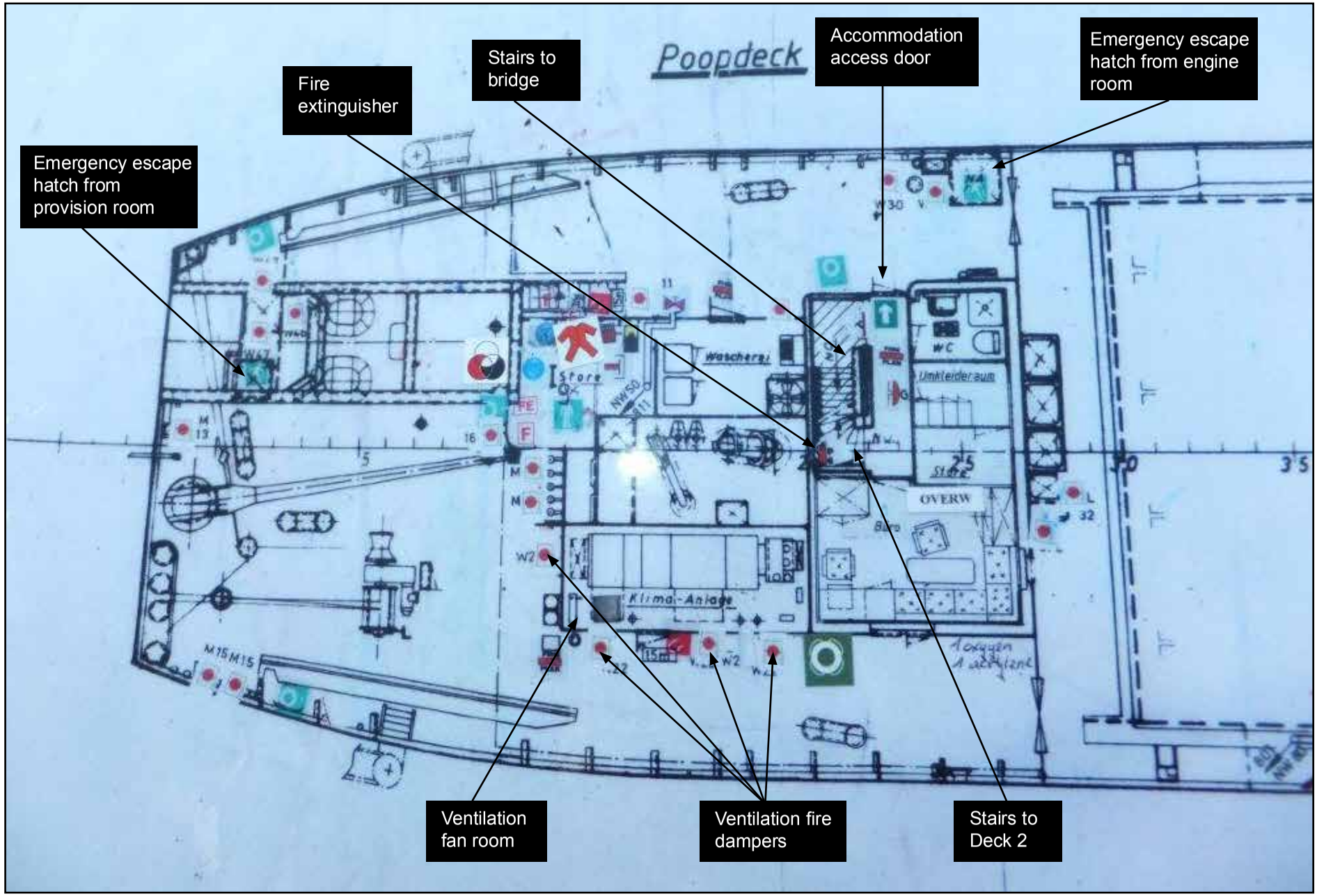



**Figure 5:** Layout of poopdeck

### 1.2.6 First re-entry and containment

The 2/O decided to carry out a re-entry of the accommodation. Assisted by the motorman, the 2/O and AB1 each donned a BA set, and the C/O recorded their BA air cylinder pressures.

AB1 led the re-entry, and he and the 2/O entered the accommodation through the aft emergency escape hatch on the poop deck. AB1 wore a life-line, and the two men carried a fire hose between them. They climbed down into the provision room, and passed through the open doorways into the galley, crew mess room and into the alleyway. The 2/O and AB1 found the conditions very hot, with thick black smoke reducing the visibility to less than 2m. The deck was awash with water as AB1 continuously sprayed the bulkheads and deckhead for about 10 minutes. The 2/O then became concerned about how much BA cylinder air might be left, and decided that they should withdraw. As he and AB1 reached the top of the emergency escape ladder, the air supply in their BA cylinders ran out. After returning to the poop deck, the air cylinders on the BA sets were replaced.

AB1 then made another attempt to enter the accommodation. He managed to proceed as far as the provision room, but then returned to the poop deck as the temperature in the accommodation had risen. Following this, the crew constrained their efforts to containing the fire by boundary cooling.

With the agreement of the C/O, the 2/O instructed the crew to rig a stage over the ship's starboard side forward of AB2's cabin porthole. AB1, wearing a variety of safety clothing he had either found or been given, then climbed down onto the stage and swung a fire hose nozzle through the porthole opening into AB2's cabin. Meanwhile, the master remained on the bridge, where he received intermittent updates on the fire-fighting efforts from the C/O and 2/O.

Smoke and flames could now be seen emanating from AB1's cabin porthole opening. The crew moved the stage forward along the ship's starboard side. A red glow could be seen through the closed porthole glass of the motorman's cabin and that the cabin door was shut. Owing to the heat radiated from AB1's cabin, it took a number of attempts for a fire hose nozzle to be swung through the porthole opening.

At about 0600, the C/E, who had been regularly visiting the engine room via the forward port side emergency escape hatch, became concerned about the amount of water draining into the engine room from the flooded accommodation. It was then decided to stop the fire/ballast pump and to wait until daylight before attempting a further inspection of the accommodation. During this time, it was noticed that the steering gear was no longer working due to a power failure.

### 1.2.7 Second re-entry

Shortly after 0800, with only vapour emanating from the porthole openings of AB1 and AB2's cabins, the master, in consultation with the C/O and C/E, decided that a further re-entry to the accommodation was now possible. To assist the re-entry, the external poop deck door to the accommodation and the accommodation ventilation fire dampers were opened, and the accommodation ventilation fans restarted. The 2/O and AB1 donned the BA sets, checked the air cylinder pressures and re-entered the accommodation via the aft emergency escape hatch. They did not take a fire hose or any portable fire extinguishers with them.

With the ventilation fans operating, visibility in the accommodation had improved and the temperature had reduced. The 2/O and AB1 proceeded around to the starboard alleyway of Deck 2. AB1 opened his cabin door and looked inside. He saw that the cabin had suffered fire damage to its upper third, and was still hot. The 2/O then left AB1 and went to his own cabin to collect his laptop computer. He then proceeded via the forward internal stairs to the poop deck.

AB1 touched the motorman's closed cabin door with the back of his hand. Not feeling any significant heat, he opened the door and looked inside. There appeared to be no major fire damage and most of the furniture was intact. He then became aware of considerable heat emanating from AB2's cabin, so returned to the poop deck via the aft emergency escape hatch.

At 0904, the master notified *Celtic Carrier*'s owner that the ship had suffered a fire in a crew cabin, which had been extinguished, that there was a considerable amount of water in the accommodation, and that the steering gear was unserviceable. The owner replied, informing the master that tug assistance had been arranged.

### 1.2.8 Re-ignition

Less than an hour later, the fire in the motorman's cabin reignited. The crew then stopped the accommodation ventilation fans and closed the accommodation ventilation fire dampers. They tried to put a fire hose nozzle through the porthole of the motorman's cabin, but were unable to break through the closed port hole glass. At 1005, having been told that the fire was out of control, the master informed the owner that the fire had restarted and that the situation was serious.

At 1007, Tarifa Maritime Rescue Co-ordination Centre (MRCC) received an emergency call from *Celtic Carrier* reporting a fire on board. Shortly afterwards, the MRCC informed *Celtic Carrier* that a variety of merchant and naval vessels were responding.

On deck, the crew began to prepare the liferaft, immersion suits, SART[2] and pyrotechnic flares in case they needed to abandon the ship. At 1025, the 2/O activated the ship's EPIRB[3], though this was subsequently cancelled by the master at 1046.

### 1.2.9 External assistance

By 1050, the Spanish naval vessel *A31 Malaespina* had arrived alongside *Celtic Carrier* and had begun to transfer two 6-man fire teams on board. The bulk carrier *Virage* arrived to provide support and the Spanish coastguard vessel *Salvamar Atria* attended the scene shortly afterwards.

By 1133, the navy fire teams and their equipment were on board. They were shown *Celtic Carrier*'s fire plan by the crew and then prepared to enter the accommodation through the aft emergency escape hatch and the external poop deck accommodation door. Shortly afterwards, *Virage* departed the scene to continue its voyage.

---

[2] A Search and Rescue Transponder (SART) is a self-contained radar beacon that is used to identify the position of a vessel in distress

[3] An Emergency Position Indicating Radio Beacon (EPIRB) is a self-contained distress beacon which, when operated, sends out a pre-defined distress signal via the international satellite system for search and rescue

By 1150, *A31 Malaespina*'s fire teams had entered the accommodation. *Salvamar Atria*'s crew broke the motorman's cabin porthole glass and directed fire-fighting foam into this and the two adjacent cabins. By 1226, the fire was reported to be under control, and was subsequently extinguished. At 1740, the tug *UOS Atlantic* arrived on scene to tow *Celtic Carrier* to Cadiz, where it arrived at 0545 on 27 April.

## 1.3 FIRE INVESTIGATION

### 1.3.1 Technical investigation of fire scene

In conjunction with an independent fire investigator, AB2's cabin was methodically excavated to ascertain the probable cause of the fire. The layout of the cabin is shown at **(Figure 3)**. Most of the furnishings were made from wood or had wood framing, and the seat and back of the sofa were made of foam with a vinyl covering. Much of this was consumed in the fire, leaving only the lower section of the bunk (including the underbunk drawers) **(Figure 6)**; the fixed table support post **(Figure 7)**, and the lower parts of the sofa's wooden frame below the porthole **(Figure 8)**. The electrical sockets and light fittings were all severely damaged, with the remains of the electrical wiring from the fluorescent light hanging down from the fitting. The remains of wires for a mobile phone charger and an electric fan heater were still connected to the sockets. The cabin door was buckled and severely heat damaged on both sides and along the door jamb, with the inner door handle and key partly melted away. The steel deckhead panel was partially dislodged above the door.

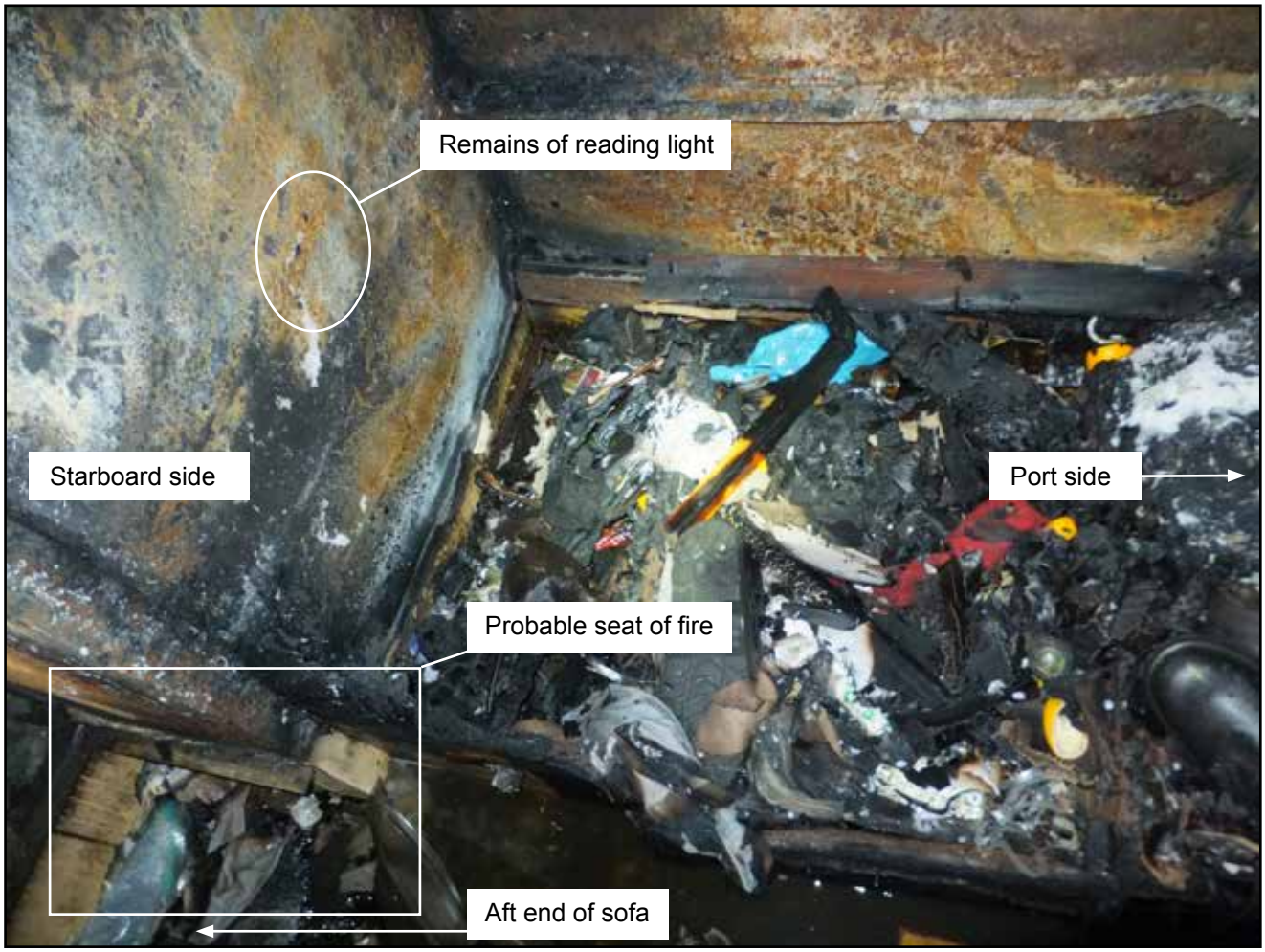



**Figure 6:** AB2's cabin fire-damaged bunk


**Figure 7:** AB2's cabin fire-damaged table


**Figure 8:** AB2's fire-damaged cabin

A range of flammable products was understood to have been in the cabin at the time of the accident. These included:

- Approximately 500ml of paint thinners in a 1 litre plastic drinks bottle on the deck by the sofa.
- Three cigarette lighters, a container of lighter fluid for recharging lighters, and newspapers on the table.
- A cigarette lighter, aftershave, and a can of deodorant spray on the shelf above the table.
- Two air fresheners and two aftershave bottles in the wardrobe cupboard.
- A waste paper bin containing newspaper, on the floor between the sofa and the table.

Apart from the container of paint thinners, the majority of these items were accounted for during the excavation. In addition, empty beer cans and beer bottles were found, and a large quantity of cigarette butts.

The remains of a 2kW electric fan heater were located on the deck; the heater was completely melted. As a potential source of ignition, the remains of the heater and the attached carpet tile were carefully removed from the cabin and examined. By comparison with an undamaged heater, the thermostat control and the two stage heat switch were identified. The heat switch was set on the 1kW (lower heat) setting, and the thermostat was adjusted to the minimum (5°C frost stat) heat setting. The remains of the wiring for the fan, heat elements and thermostat were undamaged.

The motorman's cabin had also been severely affected by the fire. Damage had occurred to all items within the cabin above about 180mm from the deck, equating to the approximate depth of water in the cabin, and little remained of the original fixtures and fittings. The steel support framework for the deckhead panels had partially buckled and several panels had fallen down, possibly as a result of the fire-fighting. In the void space above the deckhead panels were electrical cable bundles. These were orientated fore and aft, and included the power cables for the steering gear **(Figure 9)**. The porthole glass was broken, with glass fragments found on the deck below the porthole.

AB1's cabin was the least fire-damaged **(Figure 10)**. It had suffered heat damage to the upper third which had stripped the surface finish off the cabin bulkheads and deckhead. The upper section of the door jamb was also heat-marked. The lower sections, including the bunk, sofa, table, chair and lower parts of the storage cupboard were physically undamaged.

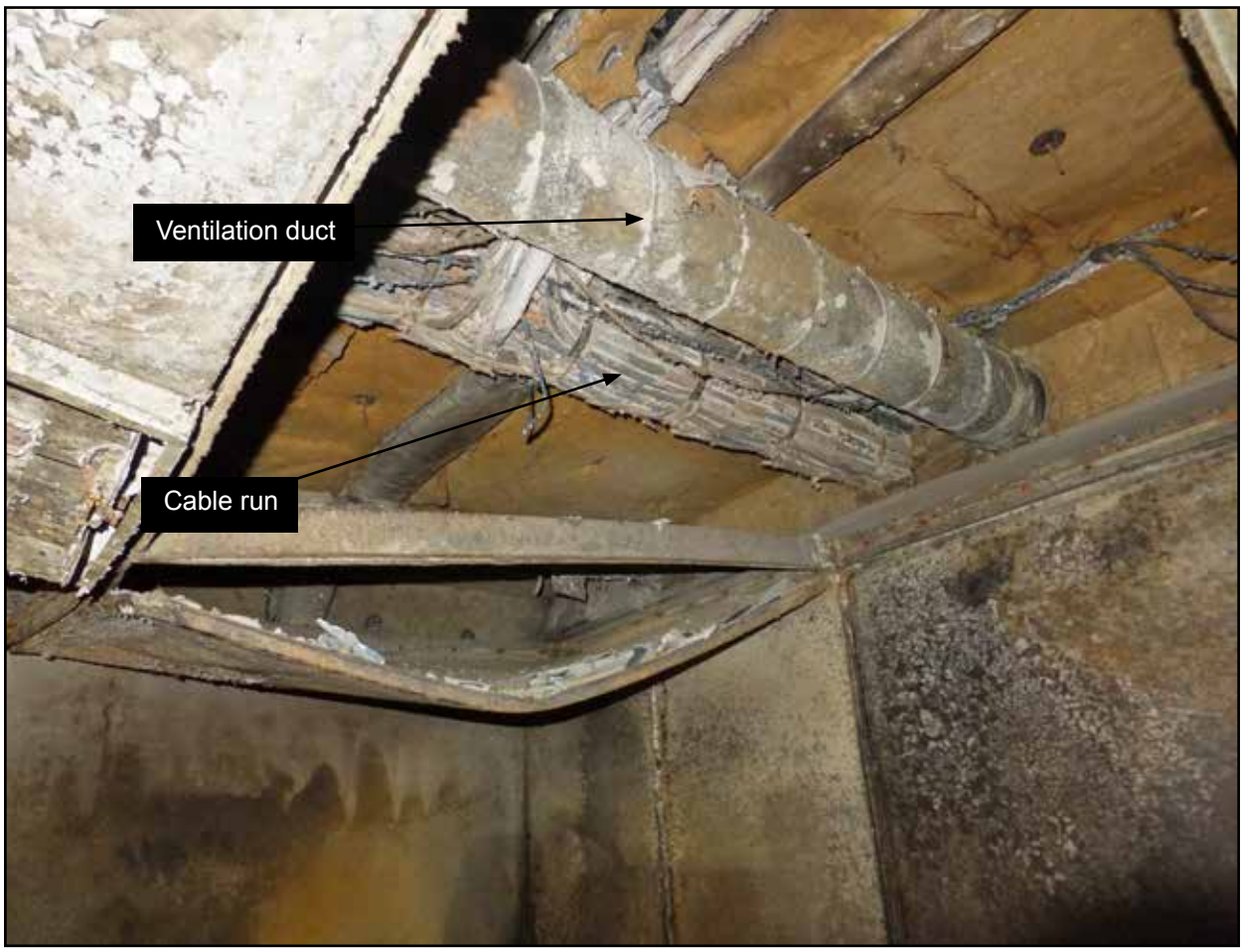



**Figure 9:** Void space above motorman's cabin and cable run

**Figure 10:** AB1's cabin - post fire

### 1.3.2 Fire tests

The undamaged sofa from AB1's cabin was identical in manufacture to AB2's. Ignitability tests were carried out to the sofa's vinyl covering and foam filling, and also to the mattress foam **(Figure 11)**. The tests found that a naked flame held to the vinyl covering caused the vinyl to melt and produce black smoke. The foam within the vinyl covering, and the foam mattress, both ignited easily and produced intense black smoke as they continued to burn, without further need of an external heat source.

**Figure 11:** Cabin mattress and sofa ignitability test

## 1.4 SHIP'S CREW

*Celtic Carrier*'s owner, Charles M. Willie & Co. Ltd (CMW), had used a Polish crewing agency over many years to crew its ships. The all-Polish crew comprised a master, chief officer, second officer, chief engineer, motorman, two ABs and a cook.

The crew had all undertaken the mandatory STCW[4] training in fire prevention and fire-fighting; the officers and the motorman had also undertaken advanced training in controlling fire-fighting operations.

[4] International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended (STCW Convention)

*Celtic Carrier*'s master was aged 60 years and had worked on board ships since 1978. He had obtained a STCW II/2 Master Mariner Certificate of Competency (CoC[5]) and an advanced fire-fighting certificate in April 2000, a UK Certificate of Equivalent Competency (CEC[6]) in December 2012, and a UK Temporary Master's Endorsement on 11 January 2013. He had served on a variety of ship types including general cargo, refrigerated cargo, ro-ro[7], container and bulk carriers. In 2012, his first contract with CMW was on *Celtic Voyager.* Contracts with CMW were normally of 4 months' duration +/- 1 month followed by 2 months' leave. He had joined *Celtic Carrier* on 29 November 2012 and was expecting to leave the vessel at the end of March 2013. However, due to the unavailability of a replacement master, he had been requested to remain on board for a further month.

The chief officer was 64 years old. He had started his career at sea as an AB in 1976. In September 2006, he joined CMW in the rank of chief officer for the first of seven contracts. Each contract was about 3 months' duration. He had served on board *Celtic Carrier* between October 2009 and February 2010. He qualified as a Chief Mate (STCW II/2) in September 2011 and was issued with a UK CEC in January 2012. He had most recently joined *Celtic Carrier* for the first time on 18 February 2013.

The second officer was 49 years of age. He had gained a Mate (STCW II/1) CoC and an advanced fire-fighting certificate in 2006. In November 2012, he attained an STCW II/2 Chief Mate CoC, followed by a UK CEC on 6 March 2013. His first voyage in 2009 as a third officer, on a bulk carrier, had been 10 months' duration. This was followed by a second contract on a refrigerated cargo ship. His third contract, and first with CMW, was on *Celtic Carrier*, which he had joined at the same time as the chief officer.

AB1 was 59 years of age and had spent most of his career at sea, 30 years as either an ordinary seaman (OS) or AB. In 1994, he had undertaken a 6-month contract with CMW, and then returned in 2006, sailing on different ships within the fleet. He had joined *Celtic Carrier* for the first time on 11 November 2012 on a 6-month contract.

AB2 was aged 48 years, and had spent 10 years at sea. He had previously worked for a German container ship operator. He had joined *Celtic Carrier* on 11 November 2012, after 2 months' leave, with a contract duration of 5.5 to 6 months. His contract on *Celtic Carrier* was his fourth with CMW, having previously sailed on board *Celtic King, Celtic Challenger* and *Celtic Venture.*

[5] All referenced Certificates of Competency were issued by the Republic of Poland in accordance with the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended

[6] In accordance with the International Convention on Standards of Training, Certification and Watchkeeping (STCW), unless the officers on board a UK registered vessel hold a UK Certificate of Competency (CoC) they require a Certificate of Equivalent Competency (CEC) issued by the MCA. CECs are available to officers who hold a CoC issued in accordance with the STCW '95 amendment from a country whose standards of competency and training are considered to be equivalent to those of the UK.

[7] Roll on, Roll off

## 1.5 *CELTIC CARRIER*

### 1.5.1 Background

Originally designed to operate on the River Rhine, *Celtic Carrier*'s keel was laid on 31 August 1984 by J.J. Sietas KG, Hamburg. The vessel was purchased by CMW in 2006, re-registered under the UK flag, and worked a busy schedule in the coastal waters of Europe and North Africa. During the 6 months before the fire, the ship had visited 19 ports.

### 1.5.2 Deck 2 fire protection

Divisions within Deck 2's accommodation space were to a B15[8] fire protection standard using the Blohm and Voss modular accommodation system 'M1000'. The M1000 system consisted of prefabricated insulated steel sections and doors in metric sizes which could be quickly connected to provide different size cabin or communal spaces. Between the M1000 deckhead panels and the insulated underside of the poop deck was a void space. The void space incorporated non-combustible draught stops between the deckhead panel and the underside of the poop deck. The accommodation ventilation ducting and electrical cable runs were located within the void. The ventilation duct in AB2's cabin was the end loop on the starboard side system.

### 1.5.3 Internal doors and accommodation ventilation

The accommodation ventilation and heating system on board *Celtic Carrier* was reported to be unreliable and noisy, and ejected dust particles from the ventilation duct outlets into the various compartments. In many of the cabins, the crew had fitted muslin cloth or similar material over the deckhead ventilation outlets to reduce the amount of dust entering their cabins. Instead of running the ventilation system, and for ease of access, the crew commonly left the internal Deck 2 accommodation doors open to allow air to freely circulate. The doors routinely left open included the access doors to the steering gear space, the forward stairwell, the crew mess room and galley, and individual cabin doors. Crew cabin portholes were also sometimes left open while the ship was at sea. The doors were fitted with mechanical hold-back mechanisms for this purpose**.** As six out of the eight crew smoked, often in their cabins, this method of air circulation was effective in maintaining a fresh atmosphere throughout the accommodation spaces. As the ventilation heating system was not commonly used, portable 2kW electric fan heaters had been put on board and were distributed among the crew cabins.

The accommodation ventilation fans were situated on the poop deck and supplied fresh air to the accommodation spaces **(Figure 5)**. The ventilation fire dampers were located on the starboard and aft sides of the accommodation block on the poop deck. A remote emergency ventilation fan stop was situated on Deck 2 adjacent to the 2/O's cabin **(Figure 1)**.

[8] "B-15" class divisions are those divisions formed by bulkheads, decks, ceilings or linings which are constructed of approved non-combustible materials capable of preventing the passage of flame to the end of the first half hour, and have an insulation value such that the average temperature of the unexposed side will not rise more than 140ºC above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225ºC above the original temperature, within 15 minutes.

### 1.5.4 Fire-fighting equipment

*Celtic Carrier* was equipped with two independent, electrically-driven, fire pumps located in the engine room. One was capable of being remotely started from the bridge and both could be started from the engine room local control position. The fire pumps supplied nine fire hydrants with their associated hoses, and jet/spray nozzles. The engine room was protected by a fixed $CO_2$ fire-fighting system comprising eight 45kg $CO_2$ cylinders, which were stored on the poop deck, and a 50kg wheeled dry powder extinguisher. In addition, there were 1 x 2kg, 10 x 6kg and 2 x 12kg dry powder portable fire extinguishers, and 1 x 5kg and 3 x 6kg $CO_2$ portable fire extinguishers located throughout the ship.

*Celtic Carrier* carried two firemen's outfits, each comprising a BA set, jacket, trousers, boots, safety gloves and tools. One outfit was located in the forecastle and the other in a fire equipment locker at the aft end of the accommodation block of the poop deck. The well-built 2/O found that the firemen's trousers were too small for him to wear and he could not button the jacket.

There were 12[9] spare 6 litre, 300 bar air cylinders[10] provided for the BA sets. There were six Emergency Escape Breathing Devices (EEBD) on board: three were located in the accommodation space, two in the engine room and one in the forecastle.

Fire plans were located externally on the starboard side of the bridge and on either side of the poop deck. Further copies were situated at the port side accommodation entrance on the poop deck and in the crew mess room.

The emergency escape route from Deck 2 was in the provision room, aft of the galley, via a vertical ladder and watertight hatch to the poop deck **(Figures 1** and **5)**. Escape from the poop deck accommodation was via an external door on the port side. The main access and egress route from the engine control room was located on the alleyway on Deck 2: the engine room emergency escape to the poop deck was located on the forward port side of the engine room.

### 1.5.5 Safety familiarisation, guidance, training, and drills

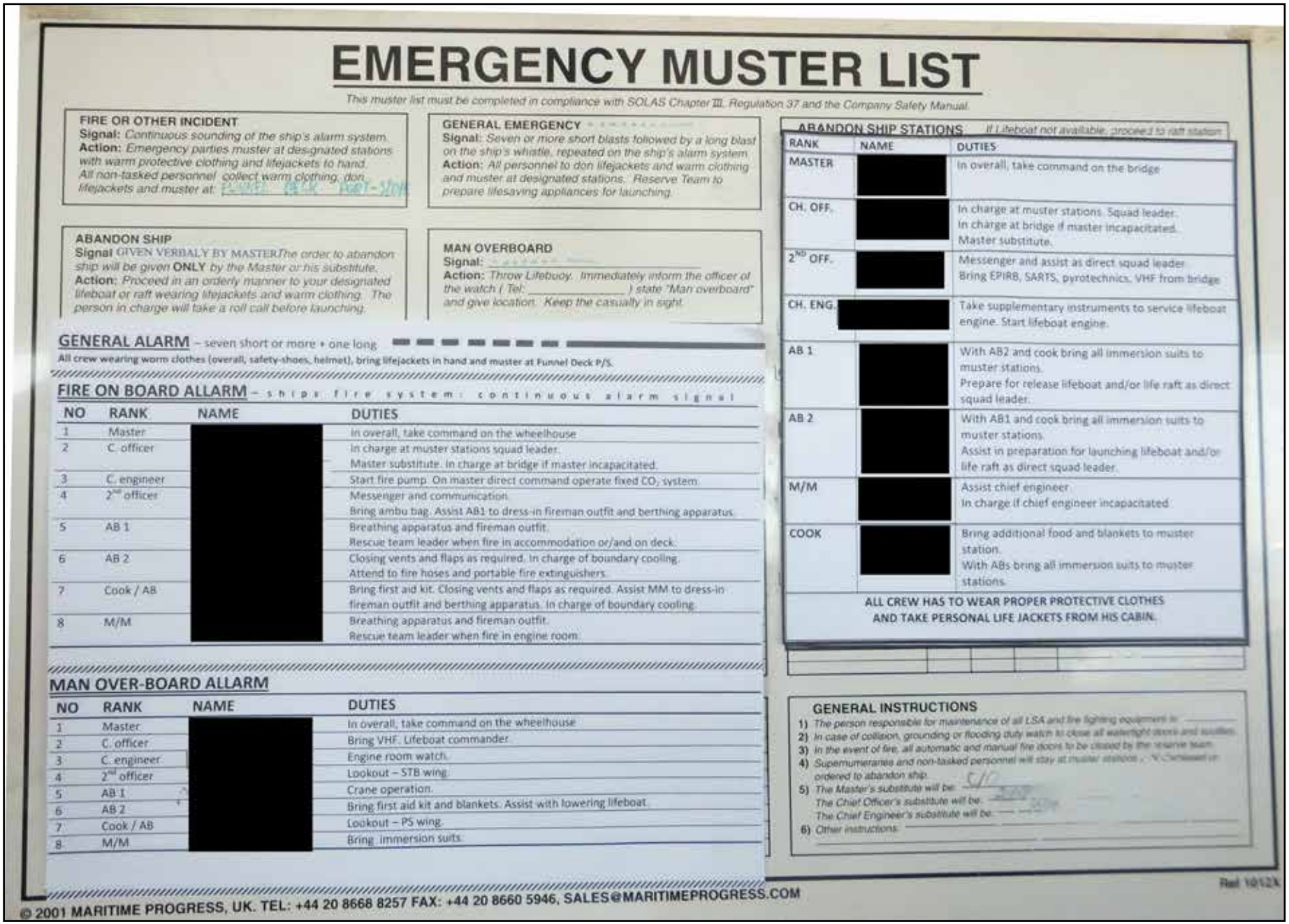
All crew newly joining *Celtic Carrier* were required to carry out a safety familiarisation to acquaint themselves with the location and operation of the lifesaving appliances and fire-fighting equipment on board, the signage used, and the procedures for communicating effectively on safety matters. The crew on board at the time of the fire had all completed the familiarisation and had signed the fire training manual, stored in the officers' mess room.

The vessel's Emergency Muster List was posted at various locations around the ship **(Figure 12)**. It detailed each crew member's duties in the event of a general emergency, fire, man overboard and abandoning the ship.

For several years CMW had contracted a company to provide fire-fighting and emergency preparedness to its crews. The last training activity on *Celtic Carrier,* on 9-10 January 2009, included a day of drill assessment followed by a day of more intense drill simulation.

[9] The shipboard fire control plan indicated six spare cylinders. These had been supplemented by a further six.

[10] The spare cylinders gave each BA set an additional 10800 litres of air.



# EMERGENCY MUSTER LIST

*This muster list must be completed in compliance with SOLAS Chapter III, Regulation 37 and the Company Safety Manual.*

**FIRE OR OTHER INCIDENT**
**Signal:** *Continuous sounding of the ship's alarm system.*
**Action:** *Emergency parties muster at designated stations with warm protective clothing and lifejackets to hand. All non-tasked personnel collect warm clothing, don lifejackets and muster at:*

**GENERAL EMERGENCY**
**Signal:** *Seven or more short blasts followed by a long blast on the ship's whistle, repeated on the ship's alarm system.*
**Action:** *All personnel to don lifejackets and warm clothing and muster at designated stations. Reserve Team to prepare lifesaving appliances for launching.*

**ABANDON SHIP**
**Signal** GIVEN VERBALY BY MASTER*The order to abandon ship will be given* **ONLY** *by the Master or his substitute.*
**Action:** *Proceed in an orderly manner to your designated lifeboat or raft wearing lifejackets and warm clothing. The person in charge will take a roll call before launching.*

**MAN OVERBOARD**
**Signal:**
**Action:** *Throw Lifebuoy. Immediately inform the officer of the watch ( Tel: _____ ) state "Man overboard" and give location. Keep the casualty in sight.*

**GENERAL ALARM** – seven short or more + one long

**All crew wearing worm clothes (overall, safety-shoes, helmet), bring lifejackets in hand and muster at Funnel Deck P/S.**

**FIRE ON BOARD ALLARM** – ships fire system: continuous alarm signal

| NO | RANK | NAME | DUTIES |
|---|---|---|---|
| 1 | Master | [redacted] | In overall, take command on the wheelhouse |
| 2 | C. officer | | In charge at muster stations squad leader.<br>Master substitute. In charge at bridge if master incapacitated. |
| 3 | C. engineer | | Start fire pump. On master direct command operate fixed $CO_2$ system |
| 4 | 2nd officer | | Messenger and communication.<br>Bring ambu bag. Assist AB1 to dress-in fireman outfit and berthing apparatus. |
| 5 | AB 1 | | Breathing apparatus and fireman outfit.<br>Rescue team leader when fire in accommodation or/and on deck. |
| 6 | AB 2 | | Closing vents and flaps as required. In charge of boundary cooling.<br>Attend to fire hoses and portable fire extinguishers. |
| 7 | Cook / AB | | Bring first aid kit. Closing vents and flaps as required. Assist MM to dress-in fireman outfit and berthing apparatus. In charge of boundary cooling. |
| 8 | M/M | | Breathing apparatus and fireman outfit.<br>Rescue team leader when fire in engine room. |

**MAN OVER-BOARD ALLARM**

| NO | RANK | NAME | DUTIES |
|---|---|---|---|
| 1 | Master | [redacted] | In overall, take command on the wheelhouse |
| 2 | C. officer | | Bring VHF. Lifeboat commander |
| 3 | C. engineer | | Engine room watch. |
| 4 | 2nd officer | | Lookout – STB wing |
| 5 | AB 1 | | Crane operation. |
| 6 | AB 2 | | Bring first aid kit and blankets. Assist with lowering lifeboat |
| 7 | Cook / AB | | Lookout – PS wing. |
| 8 | M/M | | Bring immersion suits. |

**ABANDON SHIP STATIONS** *If Lifeboat not available, proceed to raft station*

| RANK | NAME | DUTIES |
|---|---|---|
| MASTER | [redacted] | In overall, take command on the bridge |
| CH. OFF. | [redacted] | In charge at muster stations. Squad leader.<br>In charge at bridge if master incapacitated.<br>Master substitute. |
| 2ND OFF. | [redacted] | Messenger and assist as direct squad leader.<br>Bring EPIRB, SARTS, pyrotechnics, VHF from bridge |
| CH. ENG. | [redacted] | Take supplementary instruments to service lifeboat engine. Start lifeboat engine. |
| AB 1 | [redacted] | With AB2 and cook bring all immersion suits to muster stations.<br>Prepare for release lifeboat and/or life raft as direct squad leader. |
| AB 2 | [redacted] | With AB1 and cook bring all immersion suits to muster stations.<br>Assist in preparation for launching lifeboat and/or life raft as direct squad leader. |
| M/M | [redacted] | Assist chief engineer.<br>In charge if chief engineer incapacitated |
| COOK | [redacted] | Bring additional food and blankets to muster station.<br>With ABs bring all immersion suits to muster stations. |

**ALL CREW HAS TO WEAR PROPER PROTECTIVE CLOTHES AND TAKE PERSONAL LIFE JACKETS FROM HIS CABIN.**

**GENERAL INSTRUCTIONS**

1) *The person responsible for maintenance of all LSA and fire fighting equipment is* _____
2) *In case of collision, grounding or flooding duty watch to close all watertight doors and scuttles.*
3) *In the event of fire, all automatic and manual fire doors to be closed by the reserve team.*
4) *Supernumeraries and non-tasked personnel will stay at muster stations . Remained on ordered to abandon ship.*
5) *The Master's substitute will be:* S/O
   *The Chief Officer's substitute will be:* _____
   *The Chief Engineer's substitute will be:* _____
6) *Other instructions:* _____



Ref 1012A

**Figure 12:** Emergency muster list

The training provider's assessment included the following:

*'One safety critical issue was the failure to use fire hose at the safe upper entry point to the accommodation area; fire hose must always be used from the external areas not only as a means to fight fire but as a safety guide leading back to fresh air.'* [sic]

Of the ship's crew present at the time of the fire, only the cook had been on board *Celtic Carrier* during the fire training provided in 2009, and he was also the only member of the crew who had attended such an activity. AB2 had last used a portable fire extinguisher during a fire-fighting training course he had attended in 2010, and the motorman had not worn a BA set since joining *Celtic Carrier*.

*Celtic Carrier*'s Official Log Book contained a series of one-line entries to record the emergency drills conducted on board **(Figure 13)**. The record showed that on 23 January 2013, four drills (fire in the accommodation; abandon ship using a liferaft; enclosed space rescue and man overboard) were carried out consecutively in a period of 1 hour 45 minutes.

An engine room fire drill and an abandon ship drill were recorded as having taken place on 21 February 2013. The fire drill had involved the C/E showing the crew where the $CO_2$ locker was and how the $CO_2$ was discharged into the engine room, and the 2/O showing the crew the safety locker and how to wear a firemen's outfit. The fire drill did not involve a simulated fire-fighting response by the crew and lasted approximately 15 minutes. No further drills were carried out before the accident.

At the time of the fire on board *Celtic Carrier* on 26 April 2013, no formal muster was held after the fire alarm had sounded. Further, although the Emergency Muster List designated the motorman as one of the vessel's firemen, he was unwilling to don a firemen's outfit and other members of the crew were unwilling to replace him.

## 1.6 REGULATORY REQUIREMENTS AND RECOMMENDED SAFE WORKING PRACTICES

### 1.6.1 Fire protection

*Celtic Carrier* was built to meet the International Convention on the Safety of Life at Sea 1974, as amended, (SOLAS) rules on structural fire protection, which entered into force on 25 May 1980. Chapter II-2 of the Convention covered: Construction – fire protection, fire detection and fire extinction.

On joining the UK flag *Celtic Carrier* was required to comply with, among other regulations, The Merchant Shipping (Fire Protection – Large Ships) Regulations 1998, which reflect SOLAS and include the following requirements in respect of vessels of *Celtic Carrier*'s size, age and voyage type at the time of the accident:

- At least two fire pumps operated by power.
- Not less than five fire hoses, plus a spare.
- Two jets of water, not emanating from the same hydrant, to reach any part of the ship.
- Fire hoses to not exceed 18m in length.

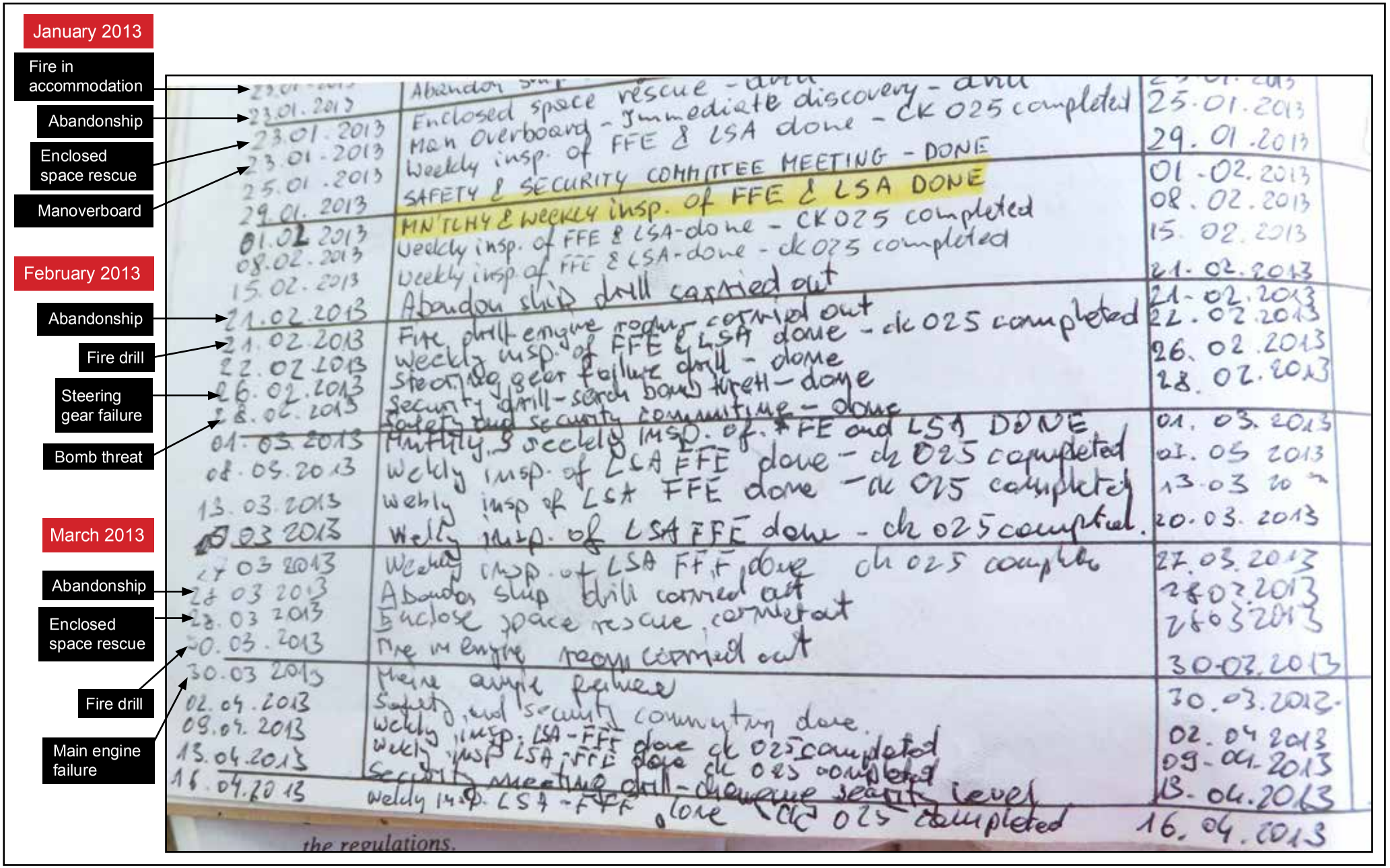



**Figure 13:** Official Log Book extract

- Every fire nozzle to be capable of producing a water spray and a plain water jet, and a shut-off facility.

- A fixed fire detection and fire alarm system in any machinery space which has been approved in lieu of continuous manning.

- Three firemen's outfits, each including a BA set with an air cylinder capacity of at least 1,200 litres of free air, and spare cylinders having a storage capacity of at least 2,400 litres of free air, unless the ship is equipped with a means of recharging.

- At least two EEBDs in accommodation spaces, and others in machinery spaces taking into account their layout and the number of persons normally working in those spaces.

- A sufficient number of (and not fewer than five) fire extinguishers to ensure at least one is readily available for use in any part of the accommodation spaces, service spaces and control stations.

- A fixed fire-extinguishing system for Category A[11] machinery spaces.

- Within the machinery space, one or more foam fire extinguishers of at least 45 litres capacity or $CO_2$ fire extinguishers of at least 16kg capacity sufficient in number to enable foam or $CO_2$ to be directed onto any part of the fuel and lubricating oil pressure systems, gearing and other areas of high fire risk.

- At least one foam applicator.

- Within the machinery space, portable fire extinguishers, at least one not more than 10m walking distance from any position from within the space.

- Interior stairways, ladders and crew lift trunks within accommodation spaces to be constructed of steel or other equivalent material.

- Stairways and ladderways to be arranged so as to provide a ready means of escape to the lifeboat embarkation deck from all crew spaces and other spaces in which crew are normally employed.

- Two means of escape from the engine room.

Owing to *Celtic Carrier*'s size and age, the sofa's upholstered foam seating and the foam mattress in the cabins were not required to meet any fire-resistant criteria. Furthermore, although the divisions within Deck 2's accommodation spaces were to a B15 fire protection standard, the ship's accommodation spaces were not required to be fitted with non-combustible internal divisions, an automatic sprinkler system or a fixed fire detection and fire alarm system.

[11] a) internal combustion type machinery used either for main propulsion purposes or for other purposes where such machinery has in the aggregate a total power output of not less than 373 kilowatts; or

b) any oil-fired boiler or oil fuel units;

### 1.6.2 Emergency muster and drill requirements

Marine Guidance Note (MGN) 71(M) provides guidance on the requirements of The Merchant Shipping (Musters, Training and Decision Support Systems) Regulations 1999. Relevant extracts from the Annex to MGN 71(M) include:

*'**2 Muster Lists***

*2.1…The master is responsible for compiling the muster list, keeping it up to date and ensuring that copies are exhibited in conspicuous places throughout the ship…*

*2.4 The muster list must show the duties to be carried out by each crew member of the ship's complement in an emergency…*

*2.8 When the muster list is compiled consideration should be given to the eventuality of key persons being unable to carry out their emergency duties through injury or for some other reason, and provision made for substitutes…*

***5 Musters and Drills – General***

*5.2 Each crew member must participate in at least one abandon ship drill and one fire drill every month...*

*5.5 Lifejackets should be worn by passengers and crew when attending musters and drills. Crew members taking part in fire and other emergency drills may remove their lifejackets if these would be a hindrance in the execution of their duties…*

***7 Fire and other Emergency Drills***

*7.1 A fire or other emergency drill shall as far as practicable be conducted as if it were an actual emergency.*

*7.3 For the purpose of a fire drill an outbreak of fire should be assumed to have occurred in some part of the ship and fire control measures simulated as appropriate. The complete cooperation of the personnel of all departments is essential in fire fighting. The type and position of the supposed fire should be varied from time to time and can include:*

*(1) Cargo fires in holds or other spaces;*

*(2) Fires involving oil, gas or chemical cargoes as appropriate;*

*(3) Fires in engine, pump or boiler rooms;*

*(4) Fires in crew or passenger accommodation; and*

*(5) Fires in galleys due to burning oil or cooking fats.*

*7.4 …The fire party or parties at the scene of the assumed fire should lay out hoses and where practicable water should be played through them…A number of portable fire extinguishers should be available and members of the fire party should be instructed in the use of the type of fire extinguisher for a particular type of fire.*

*7.5 The crew should be exercised as appropriate in the closing of openings, ie side scuttles, deadlights, doors, ventilation shafts, fire doors, the annular space around the funnel, etc both to reduce the supply of air to a fire and isolate it from other parts of the ship, especially stairways and lift shafts...*

*7.8 At each fire drill at least one extinguisher should be discharged by a different crew member in order that both crew members in fire parties and other crew members gain experience in using fire extinguishers…*

*7.10 …on cargo ships with small crews it will usually be necessary for every member of the crew to be familiar with all aspects of fire-fighting and the use of all the fire-fighting equipment provided on board the ship.*

***13 On-board Instruction, Training and Training Manuals***

*13.1 before being assigned to shipboard duties, all persons employed or engaged on a seagoing ship other than passengers, shall receive appropriate familiarisation training…*

*13.6 The training manual can be used by the officer or officers whose duty it is to give the relevant instructions and it can also be used as a source of reference and information for every member of the crew…*

***16 Records***

*16.1 The date on which musters, drills and training sessions are held, the type of drill and training held, and the occasions on which lifeboats, rescue boats and davit-launched liferafts, as applicable, are lowered or launched must be entered in the official log book.*

*16.2 Where a full muster, drill or training session as required by the Merchant Shipping (Musters, Training and Decision Support Systems) Regulations 1999, is not held a record must be made of the relevant circumstances and the extent of any muster, drill or training session held.'*

In accordance with The Merchant Shipping (Code of Safe Working Practices for Merchant Seamen) Regulations 1998, *Celtic Carrier* was required to carry on board copies of the Code of Safe Working Practices for Merchant Seamen (COSWP). Chapter 10 of COSWP contains similar guidance on emergency musters and drills to that contained in MGN 71(M).

In October 2009, the Maritime and Coastguard Agency (MCA) published *'A Master's Guide to the UK Flag'.* With regard to emergency musters and drills. The guide refers to MGN 71(M) and provides advice on recording musters, drills, training, instruction and inspections in the Official Log Book **(Annex A)**.

### 1.6.3 Fire precautions

Chapter 9 of COSWP provides a range of recommended fire precautions, including:

*'9.2.1 Conspicuous warning notices should be displayed in any part of the ship where smoking is forbidden (permanently or temporarily) and observance of them should be strictly enforced. Ashtrays or other suitable containers should be provided and used at places where smoking is authorised.*

*9.3.1 All electrical appliances should be firmly secured and served by permanent connections whenever possible.*

*9.3.9 The use of portable heaters should be avoided wherever possible. However, if they are required while the ship is in port (as temporary heating during repairs and as additional heating during inclement weather), a protective sheet of non-combustible material should be provided to stand them on to protect wooded floors or bulkheads, carpets or linoleum. Portable heaters should be provided with suitable guards and should not be positioned close to furniture or other fittings. These heaters should never be used for drying clothes etc.*

*9.3.10 Personal portable space-heating appliances of any sort should not be used at sea and notices to this effect should be displayed.*

*9.4.1 Dirty waste, rags, sawdust and other rubbish – especially if contaminated with oil – may generate heat spontaneously which may be sufficient to ignite flammable mixtures or may set the rubbish itself on fire. Such waste and rubbish should therefore be properly stored until it can be safely disposed of.'*

Chapter 12 of COSWP provides additional guidance on shipboard housekeeping, including:

*'12.5.1 Good housekeeping is an essential element in promoting health and safety on board;*

- *Equipment and other items should be safely and securely stored*.
- *Garbage and waste materials should be cleared up and disposed of correctly and promptly*;

*12.5.2 Many aerosols have volatile and inflammable contents. They should never be used or placed near naked flames or other heat source even when 'empty'. Empty canisters should be properly disposed of.'*[Sic].

### 1.6.4 Action in the event of a fire

Chapter 10 of COSWP provides guidance on action to take in the event of a fire, including:

*'10.1.3 A fire can usually be put out most easily in its first few minutes. Prompt and correct action is essential.*

*10.1.4 The alarm should be raised and the bridge informed immediately… If possible, an attempt should be made to extinguish or limit the fire, by any appropriate means readily available, either using suitable portable extinguishers or by smothering the fire as in the instance of a fat or oil fire in the galley.*

*10.1.6 Openings to the space should be shut to reduce the supply of air to the fire and to prevent it spreading…*

*10.1.7 If a space is filling with smoke and fumes, any personnel not properly equipped with breathing apparatus should get out of the space without delay; if necessary, escape should be effected by crawling on hands and knees because air close to deck level is likely to be relatively clear.*

*10.1.8 After a fire has been extinguished, precautions should be taken against its spontaneous re-ignition.'*

### 1.6.5 Requirements for watchkeeping

Merchant Shipping Notice (MSN) 1767(M) - Hours of Work, Safe Manning and Watchkeeping Revised Provisions from 1 September 2002 provides guidance on the application of the relevant regulations, including:

*'21.2 The Regulations require the master of any ship to be responsible for the overall safety of the ship. He must also ensure that the watchkeeping arrangements are adequate for maintaining safe navigational watches at all times, including the provision of a lookout as required by the International Regulations for the Prevention of Collisions at Sea 1972, as amended. Masters, owners and operators are reminded that the UK does not consider it safe for the officer of the navigational watch to act as sole look-out during periods of darkness or restricted visibility.'*

### 1.6.6 Safety management

In accordance with The Merchant Shipping (International Safety Management (ISM) Code) Regulations 1998, CMW was required to comply with the requirements of the International Safety Management (ISM) Code as it applied to CMW and to any ship owned by it or for which it had responsibility, which included *Celtic Carrier*.

The following extracts from the ISM Code are relevant to this investigation:

*'1.2.1 The objectives of the Code are to ensure safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular to the marine environment and to property.*

*1.2.2 Safety management objectives of the Company should, inter alia:*

*.3 continuously improve safety management skills of personnel ashore and aboard ships, including preparing for emergencies related both to safety and environmental protection.*

*1.2.3 The safety management system should ensure:*

*.1 compliance with mandatory rules and regulations; and*

*.2 that applicable codes, guidelines and standards recommended by the Organization, Administrations, classification societies and marine industry organizations are taken into account.*

*1.4 Every Company should develop, implement and maintain a Safety Management System which includes the following functional requirements:*

*.4 procedures for reporting accidents and non-conformities with the provisions of this Code;*

*.5 procedures to prepare for and respond to emergency situations…*

*5.1 The Company should clearly define and document the master's responsibility with regard to:*

*.5 periodically reviewing the safety management system and reporting its deficiencies to the shore based management.*

*6.3 The Company should establish procedures to ensure that new personnel and personnel transferred to new assignments related to safety and protection of the environment are given proper familiarization with their duties. Instructions which are essential to be provided prior to sailing should be identified, documented and given.*

*6.4 The Company should ensure that all personnel involved in the Company's SMS have an adequate understanding of relevant rules, regulations, codes and guidelines.*

*12.1 The Company should carry out internal safety audits on board and ashore at intervals not exceeding twelve months to verify whether safety and pollution-prevention activities comply with the safety management system. In exceptional circumstances, this interval may be exceeded by not more than three months.*

*12.2 The Company should periodically evaluate the effectiveness of the safety management system in accordance with procedures established by the Company.'*

## 1.7 FIRE RE-ENTRY DANGERS

The Fire and Rescue Service (FRS) operational guidance (GRA5.8 – flashover, backdraught and fire gas ignitions[12]) examines the hazards, risks and controls that relate to FRS staff and others who could be exposed to the phenomena of flashover, backdraught or fire gas ignition. GRA5.8 includes:

[12] General Risk Assessment, published in August 2009 by The Stationary Office with the permission of the Department for Communities and Local Government, and the Chief Fire and Rescue Adviser (CFRA)

*'Backdraught*

*A backdraught is where limited ventilation can lead to a fire in a compartment producing fire gases containing significant proportions of partial combustion products and unburnt pyrolysis products. If these accumulate, the admission of air when an opening is made to the compartment can lead to a sudden deflagration. This deflagration moving through the compartment and out of the opening is a backdraught.'*

The GRA provides two scenarios to explain the phenomenon:

*'Scenario 1*

*If the fire is still burning within a compartment when the door is opened, especially if the combustion gases are not escaping, the incoming air will mix with the gases and create an explosive mixture. If the gases within the compartment are hot enough, they will auto-ignite and flame will spread back into the compartment along with the fresh air. This would result in rapid fire growth, but not necessarily in a backdraught. Alternatively, if the gases are not sufficiently hot they will only be ignited once sufficient oxygen has reached the gases surrounding the fire. The flame will then travel across the compartment towards, and out of the doorway, driven by the expanding gases behind it.*

*Scenario 2*

*A more dangerous situation can occur if the fire in the compartment has almost died out. Once the door is opened air flows in and an explosive mixture may be created. There is the potential for ignition of these gases not to occur immediately. Once the firefighters enter the room however, and start to disturb the contents (e.g. turning over), an ignition source may be exposed and result in total flame engulfment. This is defined as a 'delayed backdraught'.'*

## 1.8 SAFETY MANAGEMENT SYSTEM

### 1.8.1 Background

CMW had owned and operated ships from its base in Cardiff since 1938. The family-run business owned ten ships and managed three others. More than half of the ships were UK-flagged and 75% of their cargoes were carried under long-term contracts between the UK, Spain, Portugal, and the Baltic and Black Sea regions.

The company's safety management system (SMS) was developed in-house by the Designated Person Ashore (DPA). The generic fleet-wide system was intended to meet the requirements of the International Safety Management (ISM) Code.

### 1.8.2 Safety and environmental policy

The SMS set out the safety policy of the company, which included:

*'Safety is the concern of all and has no rank. However, to be effective it has to be management led. To this end, the management is committed to making all personnel more safety conscious and encourage all to become actively involved in identifying possible hazards, implementing corrective action and constantly monitoring all areas of their working environment.*

*An accident is indicative of a failure in the operating system and the Company is committed to fully investigating all accidents or 'near miss' incidents. The results of such investigations and any necessary corrective action will be brought to the attention of all concerned so they may learn from such incidents.'*

### 1.8.3 Amendments

Since February 2002, CMW's SMS had been regularly updated with nine changes made in 2011 and 24 in 2012. Amendments were implemented in response to the results of audits carried out on board the company's ships or to changes in operational practices. For example, an ISM Code safety management certificate (SMC) renewal audit conducted by the MCA on board *Celtic Carrier* on 18 April 2012 noted that a risk of asbestos had not been identified. The SMS was subsequently updated on 29 May 2012 to reflect this requirement.

### 1.8.4 Non-conformities

The SMS detailed the process by which a Non-Conformity Note (NCN) was raised.

Section 7.9 – Port State Control Deficiencies included the following:

*'On completion of a PSC inspection vessel is to report to the office as soon as possible "WHATEVER" the result. (i.e. even if clear). A copy of the report is also to be sent either via e-mail or fax by agent.*

*On receipt of the PSC report office will issue NCN's clearly identifying the SMS section that the item is related to.*

*NCN's must be cleared and sent back to the office with all evidence that the deficiency has been cleared within the time stated on the PSC report. This includes items coded 17.*

*A copy of the NCN's with the clearing evidence must be attached to the PSC report and kept on the vessel.'* [sic]

Section 9.2.4 – Reporting of Accidents, Incidents and Hazardous Occurrences required the master to report all such cases to the DPA:

*'On receipt of the report the DPA will review the report together with appropriate Manager(s) concerned and they will decide if the accident, incident or hazardous occurrence has arisen due to a deficiency with the Safety Management System in which case the DPA will raise a suitable NCN and issue this to the department or person responsible for appropriate corrective action. '*

### 1.8.5 Smoking on board

The SMS provided instructions on smoking, which included:

*'1. Smoking is only permitted in locations on-board as designated by the Master.*

*2. Smoking material should be extinguished properly.*

*3. Smoking is never allowed in bed.'*

Although the crew were instructed not to smoke in the galley or mess room areas, smoking areas had not been designated on *Celtic Carrier*, and the deck, bridge and bridge wings were commonly used. Of the eight crew on board *Celtic Carrier*, six smoked, including several who did so in their cabins.

### 1.8.6 Alcohol on board

The SMS stated the company's drug and alcohol policy, which included:

> *'…any form of alcohol abuse is prohibited on board Company's ships. Seafarers must be aware that:*
>
> - *each crew member is restricted to maximum of 4 units[13] of alcohol per day;*
> - *alcohol is not to be consumed within 8 hours of one's watch or duty;*
> - *no crew member may be intoxicated while aboard ship;* [sic]'

### 1.8.7 Working hours schedule

The working hours schedule for AB1 and AB2 is shown at Table 1:

| Position | Daily work hours at sea | | | | Daily work hours in port | | | | Total daily rest hours | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Watchkeeping | | Non-watchkeeping | | Watchkeeping | | Non-watchkeeping | | At sea | In port |
| AB1 | 2200-2400 | 0000-0200 | 0800-1200 | 1300-1500 | 0000-0600 | 1200-1800 | | | 14 | 12 |
| AB2 | 0200-0600 | | 1000-1200 | 1300-1700 | 0600-1200 | 1800-2400 | | | 14 | 12 |

**Table 1 – Working hours schedule for AB1 and AB2**

The SMS included a number of remarks in respect of the watchkeeping arrangements, including:

> *'3. Deck ratings' lookout watches at sea have to be performed from dusk to dawn, in restricted visibility and/or heavy traffic as well as on demand.'*

The SMS also required the cook to carry out bridge lookout duty as required.

Time sheets completed for AB1 and AB2 reflected their scheduled hours of work but did not reflect their actual working hours. Neither AB stood a bridge watch during their allotted times, and they commonly worked day work (0800-1700) or as the cargo loading and unloading operations in port demanded. It was decided on board that the scope of other work required meant that it was necessary for AB1 and AB2 to forego bridge watchkeeping duties in order that they gained sufficient rest. Consequently, bridge logbook entries, which stated that the ABs had acted as lookout, and had conducted fire rounds during their scheduled watchkeeping periods, were false **(Figure 14)**.

[13] One unit of alcohol is approximately equivalent to half a pint of normal strength lager or a single shot of spirits

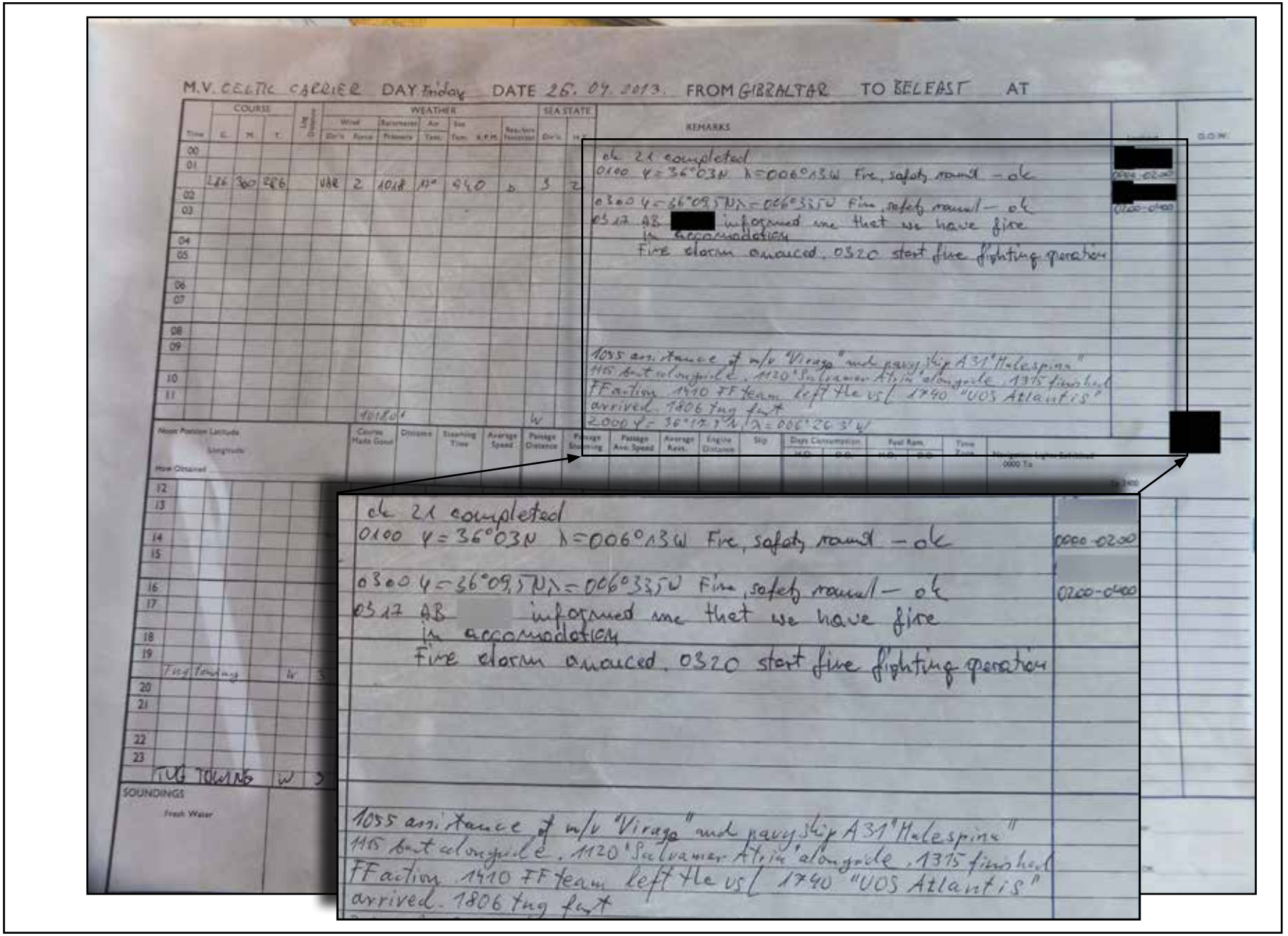



**Figure 14:** Bridge logbook

### 1.8.8 Emergency fire drills

CMW established a range of shipboard drills to meet The Merchant Shipping (Musters, Training and Decision Support Systems) Regulations 1999. For the fire drills, the Company requirements were:

*'MINIMUM MONTHLY FOR ALL CREW*

- *Accommodation*
- *Engine Room a) Fought by Hand*

  *b) Fought with Fixed Installation*
- *Cargo Space a) Fought by Hand*

  *b) Fought with Fixed Installation*
- *Galley*
- *Paint Store*
- *Forecastle*
- *Bridge'*

The above scenarios were intended to be rotated throughout the year to ensure that the crew gained regular experience in all of them.

In addition to making an entry in the Official Log Book, the SMS required a *'Fire Drill Report'* to be completed following each emergency fire drill, and a report covering all safety drills carried out each month to be included in a ship's *'Safety and Security Committee Meeting Report.'* A separate schedule of emergency drills to be performed and a record of their completion was kept on the bridge, and an operational emergency checklist was provided to assist with command and control in the event of a fire.

During the investigation a number of recently completed *'Fire Drill Report'*s and *'Safety and Security Committee Meeting Report'*s were noted as containing similar or even identical remarks, often with differences only in the date and time of the drill. It was also noted that the operational emergency checklist had apparently not been used since 16 November 2012.

### 1.8.9 Other records

*Celtic Carrier*'s Safety Planned Maintenance Schedule provided the following instructions for the internal fire doors:

*'Job No: 24.0 Weekly*

*Access to all fire doors to remain clear at all times. Doors should not be held back by any means unless there is magnetic release.*

*Job No: 24.1 Monthly*

*Check the structure of the door and ensure it is in good condition. Lubricate the hinges as necessary*

*All self-closing devices should FULLY close the door and not leave it slightly ajar.'*

The weekly and monthly inspections of the fire doors were recorded as having last been completed on 1 and 2 March 2013 respectively.

On 30 April 2013, the steering gear access door was found open and hooked back with its hinges rusted and seized **(Figure 15)**.

CMW provided a range of checklists to ensure the ship's spaces, equipment and documentation were being inspected and updated as necessary. These included the master's initial inspection report checklist, intended for completion by a new master within 1 month of his joining the ship.

In respect of the master's checklist, the SMS stated:

*'If any deficiencies are found that cause concern to the Master, the Company must be informed immediately, so that action can be taken to remedy the problem. This checklist will be reviewed by a superintendent.'* [sic]

The checklist covered all aspects of the ship, including the holding of fire and abandon ship drills and the condition of fire doors. It was recorded as having been completed with all items in order on 20 December 2012, about 3 weeks after the master had joined *Celtic Carrier*. On 9 January 2013, the checklist was countersigned by the DPA.

The Safety Planned Maintenance Schedule also provided instructions for the firemen's outfits. The BA sets required weekly and monthly checks and an annual service. The weekly check was recorded as having been carried out on 1 March 2013. However, a separate weekly safety checklist, which included the firemen's outfits, indicated a last inspection date of 2 February 2013, and a further checklist on the bridge indicated that the fire-fighting equipment had been tested on 1 February 2013, 1 March 2013 and 16 April 2013.

A steering gear failure drill and a security drill, recorded in the Official Log Book as having been conducted on 26 and 28 February 2013 respectively, were found not to have been carried out **(Figure 13)**. The reported reason for the drills not being conducted was insufficient time due to the ship's work schedule. Similarly, although an abandon ship drill and an enclosed space rescue drill, and an engine room fire drill and a main engine failure drill were recorded as having been completed on 28 and 30 March respectively, no further emergency drills were actually carried out between 21 February and the accident on 26 April 2013.

A *'Security Drill and Training Schedule'*, developed in compliance with the ISPS[14] Code and requiring a particular type of drill to be conducted every 2 months, indicated that the last drill had occurred on 20 July 2012.

[14] International Ship and Port Facility Security



**Figure 15:** Steering gear door hinges

On 26 April 2013, no records were made in the ship's bridge logbook between the 0320 entry indicating the sounding of the fire alarm and the start of the fire-fighting response (recorded by the 2/O), and the 1055 entry, indicating that *Virage* and *A31 Malaespina* had arrived on scene (recorded by the C/O) **(Figure 14)**.

### 1.8.10 Emergency reporting

CMW's SMS included a description and the contact details of its Company Emergency Response Team, some of whose members were on call 24 hours a day ready to respond immediately to emergencies on board the company's vessels.

## 1.9 INSPECTIONS AND AUDITS

### 1.9.1 Port State Control inspection history of *Celtic Carrier*

*Celtic Carrier* operated predominantly around the Paris Memorandum of Understanding (PMoU) port state control (PSC) region[15]. Between the vessel's change of ownership in October 2006 and November 2012 it had been subject to 21 PSC inspections in 11 countries. Of these, the Spanish Administration had inspected *Celtic Carrier* the highest number of times (7); had found the highest number of deficiencies on the ship during an inspection (24 deficiencies recorded on 5 January 2009); and had identified the highest total number of deficiencies on the ship (54) per PSC Administration.

With the exception of an inspection carried out in 2010, all PSC inspections conducted during the 4 years from 2009 found fire safety related deficiencies. ISM Code related deficiencies were also apparent. These deficiencies included:

Marin, Spain, 5 January 2009 (24 deficiencies, detention[16]):

- *'Doors – inoperative. Self-closing door devices inoperative*.
- *Smoke detectors – not properly maintained. Number of smoke detectors: according to the master, one; there are 3 at least.*
- *Fire doors – not as required. Gaskets wrong material in engine room and galley.*
- *Emergency lights – not as required. Missing periodical test, it written but not done.*
- *ISM – lack of good knowledge. Lack of knowledge of SMM. Lack of crew training, rectify non-conformity within three months.*
- *Emergency preparedness – insufficient'.* [sic]

Castellon de la Plana, Spain, 23 March 2009 (8 deficiencies):

- *'Emergency preparedness – not according SMS. Emergency drill shore – vessel to be carried out.*

[15] The organisation consists of 27 participating maritime administrations

[16] Relating to: machinery control alarm; UMS alarms; oil/water 15ppm alarm arrangements

- *Resources and personnel – not according SMS. Outstanding deficiency (05/01/09). Master crew familiarisation to be improved not later 06/04/09.'* [sic]

Castellon de la Plana, Spain, 18 February 2011 (10 deficiencies):

- *'Manuals – lack of familiarity. Training manuals, fire and LSA (ISM).*
- *Tables of working hours – not as required. Not in accordance with rest hour records – motorman (ISM).*
- *Fire detection – not as required. General fire alarm not working when fire alarm is 'ON'.*
- *ISM – not as required. Deficiencies marked (ISM) are objective evidence of a failure or lack of effectiveness of the implementation of the ISM Code.'* [sic]

Castellon de la Plana, Spain, 8 August 2011 (5 deficiencies):

- *'Last report Castellon 18/02/11 deficiencies ISM. An internal audit by company is carried out on date 08/04/11, Port Fowey.*
- *Fire alarm – not as required. Corridor alarm not working. Rectified.*
- *Retention oil on board – not as required. The following transfer are not allowed. Bilge water in to sludge tank…one evidence of a failure of ISM Code. A internal audit must be carried out by company.'* [sic]

Waterford, Ireland, 5 September 2011 (5 deficiencies):

- *'ISM – not as required. The deficiency regarding the chief mate not having working shoes indicates that the on board safety management system is not functioning correctly.*
- *Electrical devices – unsafe. Evidence of overloading of electrical sockets, poor electrical wiring in cabins and in wheelhouse.'*

### 1.9.2 Paris Memorandum of Understanding guidelines

The Paris Memorandum of Understanding (MoU) guidelines[17] to PSC officers regarding implementation of the ISM Code includes:

*'D. Areas which may warrant detention.*

*The following items may be considered as major non-conformities* and would make the vessel liable for detention. This list is not considered exhaustive but is intended to give an example of relevant items.*

*Section of the ISM Code:*

*13 ISM certificates not on board*

*13 Company on the DOC not the same as on the SMC.*

[17]Revision 14

*1.4 Safety Management documentation not on board.*

*6.6 Relevant safety information not in a working language or a language understood by the crew.*

*3 + 4 Senior officers unable to identify operator and designated person*

*(ship/shore system breaks down with this).*

*8.3 No procedures to contact the company in emergency situations.*

*8.2 Drills have not been carried out according to program.*

*6.3 New crew members are not familiar with their duties within the SMS.*

*5 Master's overriding authority not documented and master unaware of his authority.*

*10.2 No records of maintenance kept or no evidence of maintenance being carried out as indicated in the records.*

** Major non-conformity means an identifiable deviation which poses a serious threat to personnel or ship or a serious risk to the environment and requires immediate actions; in addition, the lack of effective and systematic implementation of a requirement of the ISM Code is also considered as a major non-conformity. A ship must correct all major non-conformities before departure.'*

### 1.9.3 MCA's ISM Code audit system

Chapter 4 of the MCA's ISM Code instructions for the guidance of surveyors provides instructions on conducting DoC and SMC audits. The following extracts are relevant to this investigation:

*'4.3 The responsibilities of the lead auditor include the following:*

- *After completion of the audit report the auditor should send the audit report with non conformity notes to HQ ISM/ISO Branch by fax or e-mail prior to sending the complete file. The file should be sent after closure of all non-conformities…*

*4.5 During the course of the audit the auditor(s) may raise non-conformities against the SMS. Non-conformities are identifiable deviations within the SMS…*

*'4.6 The objectives of the ISM Code are to ensure safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular, to the marine environment and to property. The achievement of these goals is heavily dependent on the human element ie the people who operate the system. The knowledge and experience of the officers and crew, their familiarity with the Company's SMS, their training and records thereof should be checked by observation and interview. Where practicable, the auditor(s) should witness as many on board procedures as practicable and these may include, but are not limited to*:

- *…onboard training;*
- *new joiner (crew) instructions;*
- *emergency drills;*
- *safety committee meetings…*

*…In the case of ships other than passenger ships an emergency drill should be witnessed at the time of the SMC audit…'*

*4.7 An observation means a statement of fact made during a safety management audit and substantiated by objective evidence of the corrective action taken for an Observation.*

*4.8 A non-conformity means an observed situation where objective evidence indicates the non-fulfilment of a specified requirement of the ISM Code. A non-conformity should be normally closed out within three months from the date of the audit.*

*4.9 A major non-conformity means an identifiable deviation which poses a serious threat to the safety of personnel or the ship or a serious risk to the environment and requires immediate corrective action and includes the lack of effective and systematic implementation of a requirement of the ISM Code.*

*A major non-conformity on ship audits requires downgrading to a non-conformity in order to allow the vessel to sail (Ref. MEPC.Circ 1059 of 16-12-2002).*

*4.14 …A significant number of minor non-conformities identified against the same section of the ISM Code may be issued as a single major non-conformity….*

*When an auditor identifies a potential minor non-conformity, agreement must be reached with the manager of the department or area concerned that the perceived non-conformity actually exists…Suitable corrective actions and appropriate corrective action time-scales must also be discussed and agreed with the company. Auditors are reminded that corrective action times cannot exceed three months. In the event that a company cannot complete a corrective action within the maximum time of three months, the non-conformity note is to be closed out and another raised…*

*4.15 …Closing-out of minor non-conformities will not normally require a revisit by an auditor. Written notification of the completion of corrective action, accompanied where possible by objective evidence, shall be forwarded to the lead auditor through the Designated Person. This should be accompanied by the appropriate copy of the Non-Conformity Note. When the lead auditor is satisfied that the agreed corrective action has been completed the Non-Conformity Note will be closed out, signed and returned to the Designated Person. During annual audits the opportunity should be taken to confirm that non-conformity notes raised at the previous audit have been closed out on time. The corrective actions may also be verified. In the case of SMC audits the foregoing may be achieved during either the next intermediate audit or a General Inspection.'*

The MCA relied on a paper-based management system to record the results of its ISM audit activities. Although an IT system was under development, there was no national database for such information. Accordingly, individual marine offices maintained their own systems to track and follow up non conformities. Additionally, audit files were required to be forwarded to the ISM/ISO Branch at the MCA's headquarters for review. However, the paper-based system allowed the possibility that audit findings and outstanding audit non-conformities were not always reported up the management chain.

Chapter 13 of the MCA's ISM Code instructions for the guidance of surveyors provides instructions on certification and periodic verification. The following extract is relevant to this investigation:

*'13.4 …The validity of the DOC is subject to annual verification the window for which is three months either side of the anniversary date. The annual verification should include an examination of:*

- *the reports of internal audits of offices and ships;*
- *follow up of corrective action and closing out of non-conformities;*
- *records of management reviews;*
- *reporting of accidents, hazardous occurrences and non-conformities;*
- *amendments to procedures, instructions and revisions to*
- *documentation;*
- *recruiting and training records of staff, ashore and seagoing;*
- *reports of inspections of ships;*
- *forward planning schedules for the SMC Audits of the company's ships; and*
- *reports on any Initial, Intermediate or Renewal Audits conducted to date*.'

### **1.9.4** Safety management certificate audit of *Celtic Carrier*

MCA surveyors from an assigned MCA Marine Office conducted SMC renewal, ILO[18] Convention and ISPS Code audits concurrent with a General Inspection[19] of the ship at Birkenhead on 18 April 2012. In preparation for the audit, a review of the audit history of the company and its fleet was undertaken and, during the audit a fire and abandon ship drill was held to the MCA surveyor's satisfaction. The SMC audit resulted in one observation[20] and one non-conformity[21]. The audit report summary included:

[18] International Labour Organization

[19] A general inspection of the fire safety systems and appliances, life-saving appliances and arrangements, navigational equipment, means of embarkation for pilots and other equipment to ensure that the ship has been maintained to conform with the provisions of the relevant regulations and is fit to proceed to sea.

[20] Identification of asbestos risk on the vessel.

[21] The vessel's working language was Polish, but almost all notices were in English. The lack of understanding of English by certain crew, in particular the chief engineer, presented challenges in conducting part of the audit through the master as interpreter.

*'During the audit there were a number of points raised as deficiencies on the General Inspection and other points discussed to support continual SMS improvement. These included:*

1. *Official Logbooks compulsory entries missing. These mainly related to a lack of knowledge of the required entries for the Narrative section and to specific details in other sections. It is recommended that the company supply support information/training on OLB entries for Masters. This information comes not just in the Merchant Shipping (Official Log Books Regulations 1981 (and as amended 1991) but also in several other Statutory Instruments where a law requires an OLB entry on a specific point.*

3. *The vessel has had PSC 13 inspections since 08/01/09, been detained twice within a 2 year period. A standard risk ship in that time would normally have only 4 inspections. If this vessel was under a Grey Flag it would have been banned from PMoU region. The deficiency numbers were 24,8,3,4,3,0,3,10,5,5,2,8,0. The risk is that with even a few deficiencies a vessel can be detained as 'ISM system not working'. I discussed with the Master and Mr* [X] *the Port state performance of the ship and advised him that there is much useful information available for all on the PMOU website. It was highlighted that the deficiencies and detentions affect not only the vessel and company performance but also that of the Flag, Class and RO, all of which are monitored on a daily basis in the system. It is noted that efforts are being made to improve the performance. While company gives support to the Master on Port state, on board awareness of deficiency monitoring needs to be promoted.*

6. *A deficiency was raised for logging of lookout. Several entries did not have a lookout entered after 0600 in the morning and times of sunrise were checked. The company is recommended to check that times of lookout duties start and finish are recorded as evidence of compliance with Colregs for Port state or any other logbook inspection and verification of hours of rest.*

7. *We discussed non-conformances and the evidence from the ship was that these are only raised by the office. We were not able to find any NCRs raised by the ship and the Master believed NCRs were office raised. This would not be the way ISM works nor is it as described in the ship SMS.'*

The SMC audit report and the NCN were subsequently sent to the MCA headquarters. No comments on the audit report were made and the non-conformity was closed out by the MCA on 10 July 2012.

The ISPS Code audit report summary included:

*'No Non-Compliances/Observations/Deficiencies were raised; the only remark to be made was that the Company should instigate a procedure to chase audit reports not forwarded to them within a reasonable time period.'*

### 1.9.5 Safety management certificate audits of other CMW ships

A review of the reports of recent SMC audits conducted on the other UK-flagged CMW ships highlighted similar ISM Code issues to those identified in respect of *Celtic Carrier*, for example:

Intermediate audit held on 2 March 2010:

- *'The master was on his first contract with the company and had previously served on a wind farm guard vessel, he had not sailed on a vessel with SMC for 3 years. Prior to taking up his appointment he had only taken part in a telephone interview with the Company. The policy of appointment of new Masters should be reviewed and updated'.*

- '*No clear records on the last occasion the freefall lifeboat was slipway launched, or when last simulated launch was carried out. The frequency should be in accordance with SOLAS'.*

Intermediate audit held on 18-19 July 2011:

- A poor understanding of the SMS by the crew *'as it was evident that direct references to the SMS manual did not elicit much of a response',* and '*Officers and Crew members need to be more 'involved' in the running of the onboard Safety Management System effectively and not simply pay a 'lip service' to it'.'*

- Drill maintenance and records were found to have been completed by the safety officer without having been undertaken. '*This could have resulted in a Major Non-Conformity being issued to the vessel, but was not considering the tenure on board of the concerned officer and his relevant background'.*

- Fire drills were carried out twice during the audit. '*The first drill, held in the galley showed a distinct lack of Command and Control, and fire fighters were left to their own devices to fight the fire as the seat of the fire was unknown to them'*, and the safety officer did not know how to use a BA set in respect of the operation of the demand valve.

- *'The Chief Mates knowledge of duration of re-entry to an enclosed space after it has been flooded with CO2 was also asking'.*[sic]

Renewal audit held on 7 December 2011:

- *'During December around the UK coast, the OOW had been the sole lookout on* [name of ship] *during darkness until 20:00 and from 06:00'.*

- *'The Company has established a safety and environmental protection policy. Two senior officers were unable to show me the policy in the safety management manual. A non-conformity for lack of familiarity with the policy was issued at the previous flag state audit two years ago, suggesting that continual improvement in this area has not been achieved'.*

- *'The Master exhibited uncertainty when questioned on whether his authority to make safety-related decisions was overriding, and he could not readily locate in the safety management system a clear statement emphasizing this authority. The Master reviews the safety management system once each contract. The quality of the reviews appears questionable from office comments in response to reviews in May and August:*

  > *"This is a review that ticks all the boxes but that does not actually tell us very much about ISM on the vessel" 07/06/2011*

*"Obvious that the last office comments have been read but no real notice has been taken of them" 14/09/2011*

*These comments appear to identify a requirement for training the Master in support of the SMS review process. Section 6.5 of the ISM Code requires the Company to ensure that such training is provided'.*

- '*While the Master was qualified for command, much difficulty was evident in locating contents of the SMS and documentation relating thereto, which indicates that conversance with the system is less than full. The same finding was documented in the report from the previous flag state audit two years ago, suggesting that continual improvement in this area has not been achieved*'.

- '*A fire and abandon ship drill was conducted during the audit and NC 2011/03 was raised in respect of a lack of familiarity with emergency procedures evidenced by the following observations*:

  - *No checklist was used by the master in support of command and control of the incident, despite a specific SMS requirement to do so*.

  - *A crewmember entered the scene of a fire wearing a breathing apparatus incorrectly donned such that a large leak was audibly apparent, and failed to react appropriately to the bottle low-level whistle when it sounded*'.

- *'Non-conformity 2011/04 was raised in respect of a number of deficiencies that indicate a lack of maintenance of the lifeboats and their launching appliances'.*

- *The Company has a system to ensure that non-conformities, accidents and hazardous situations are reported and analysed. However, onboard records indicate that no near misses have been reported in the last four years, and two senior Officers exhibited a lack of understanding of the concept of near miss reporting'.*

  *The Guidance on Near Miss Reporting in the 2010 Code gives advice on overcoming barriers to reporting (p.70), and states that one of the main impediments is the fear of being blamed or embarrassed. In this regard, the Company's response to the ship's most recent accident report (16/07/2011), namely that a seafarer's action had been "… a very dangerous and stupid thing to do", is unlikely to be conducive to the encouragement of reporting'.*

Renewal audit held on 7 January 2012:

- '*Although a documented shipboard familiarisation system is in place, a sample examination of the Second Officer's familiarity with the ship's Navtex receiver revealed a clear lack of familiarity. I note that*:

  - *The last flag state audit in March 2010 identified a non-conformity relating to the 2/O's lack of familiarity with safety duties; and*

  - *The previous flag state audit in November 2009 also identified a non-conformity relating to familiarisation forms being signed without full knowledge of the relevant item*.

*This suggests that there are ongoing shortcomings in this area'.*

- '*A number of recent non-conformity reports were sampled, and it was recorded under non-conformity 2012/02 that the ISM Code requirement for corrective actions to include measures to prevent recurrence had not been implemented in the following examples*…'.

Renewal audit held on 3 February 2012:

- '*The fire drill was unsatisfactory as the fire fighters did not return back to the seat of the fire after rescuing the imaginary casualty. A non-conformity has been raised on this account*'.

A number of the above issues resulted in either observations or non-conformities being issued by the auditor. Other issues identified included: poor language abilities by a senior deck officer, the SMS apparently not complying with The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997, poor SMS document control and overdue maintenance of alarms.

### 1.9.6 Document of compliance audit of CMW

A DoC renewal audit was conducted at CMW's offices on 30 May 2012. The audit resulted in one non-conformity and four observations. These included: the shore organisational structure described in the SMS was different from the structure in operation due to the Company not having a marine superintendent; there was no clearly defined job description for the master of company vessels; the job description for the safety officer in the SMS did not include all the duties required by The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997; and the required frequency of training exercises for the shore emergency response team was not specified in the SMS.

The audit report included the following remarks:

Section *5 'Masters Responsibility and Authority'*:

*'The Masters responsibility and Authority are specified in section 5 of the Safety Management System Manual. Support is given to the Master at various levels when requested and the decisions Masters make are supported and reviewed at a later date'.*

Section *6 'Resources and Personnel'*:

*'Resources & personnel procedures are specified in section 6 of the Safety Management Manual. There is a commitment to ensure that vessel are adequately manned with qualified, trained and medically fit personnel'.* [sic]

*'The Company have developed various forms to verify the training and familiarisation carried out on board the vessel…'.* [sic]

Section *9 'Reports and analysis of Non-Conformities Accidents and Hazardous Occurrences'*:

*'Section 9 of the Safety Management Manual states procedure to ensure Non Conformities, accidents and hazardous situations are reported and reviewed by the company including the implementation of any corrective actions throughout the Company's Fleet to improve safety and protection of the environment. Report MMOSO20 dated 24/06/11 reviewed regarding accident whilst using a ladder'.* [sic]

The audit report summary included:

*'The company's Safety Management System (SMS) is well established and comprehensive. There is evidence that it is continually under review, updated and improved. … Evidence viewed during the audit indicated that the documented SMS is representative of how the company operates'.*

*'On completion of the audit it was determined that the Safety Management System is active and, subject audit findings, meets the necessary requirements'.*

### 1.9.7 Alternative Compliance Scheme

*Celtic Carrier* had benefitted from the Alternative Compliance Scheme (ACS) since July 2007. The ACS, detailed in MGN 345(M), was intended to streamline the ship survey and certification process while maintaining standards and minimising duplication of effort with classification societies. It did this by delegating all survey work to UK Flag State authorised classification societies, and set out the responsibilities for the owner/operator, the MCA and the classification society. The MCA, as Flag State, maintained oversight through an annual survey, which included ISM and ISPS Code audits, and an ILO Convention inspection.

The MGN sets out eligibility criteria for vessels to be considered, which include:

- 'The vessel has not been detained within the previous 36 months.
- During any port state control inspection within the previous 12 months no inspection report shall have recorded more than 5 deficiencies…'.

### 1.9.8 Company internal audits

SMS/ISPS Code internal audits of the CMW fleet by the ships' superintendents were usually carried out when the ship was alongside in a UK port. *Celtic Carrier*'s audit action report, following an internal audit carried out on 30 November 2012 at Garston, found six non-conformities and four observations. These included:

- The safety officer was not aware of the risk assessment manual, and no risk assessments had been filed in the previous 8 months.
- The recording of alarm testing was incomplete.
- The logbook records of safety rounds were found to be identical in their wording, and the safety rounds had not been recorded in the Official Log Book for 8 months.
- No suspicious item/bomb drill had been completed in the previous 22 months.

- An officer showed a lack of knowledge of the locations of the shipboard security plans.

The audit also found that no hazardous incidents had been reported in the previous year.

The resulting NCNs were given to the master for completion of the *'root cause analysis'* and *'proposed corrective action'* sections.

The SMS stated:

> *'Corrective action must include procedures either in the operation of the vessel or within the SMS itself that ensure no re-occurrence of the same failure can occur.*
>
> *Appropriate corrective action may be:-*
>
> - *Revision of a procedure or operating instruction.*
> - *Issue of a new procedure or operating instruction.*
> - *Ensuring that personnel adhere to safety procedures.*
> - *Further training/education.'*

The proposed corrective action for the NCN relating to the safety rounds, with an agreed date for completion of 30 January 2013, stated:

> *'The second officer should do the safety walk round with C/O and reports should be notified in official log book.'* [sic]

A subsequent follow-up internal audit report on 4 January 2013 stated:

> *'Although the NCN has been cleared directly, no mention of the rounds is made in the safety meeting minutes.'*

The NCN was closed out on 16 February 2013 without implementation of a type of corrective action required by the SMS.

## 1.10 ISM CODE GUIDELINES

In 2007, the IMO[22] Maritime Safety Committee (MSC) and the Marine Environment Protection Committee (MEPC) approved guidelines for the operational implementation of the ISM Code by companies **(Annex B)**. This resulted from a report produced by a group of independent experts on the impact of the ISM Code and its effectiveness in the enhancement of safety of life at sea and protection of the marine environment.

In 2008, in support of the 'hazardous occurrences' reporting requirement within the ISM Code, the MSC and MEPC further approved guidelines to encourage the reporting of near-miss occurrences and to promote a *'just culture'* **(Annex C)**.

[22] International Maritime Organization

## 1.11 BEHAVIOURAL SAFETY

In 2011, in response to concerns over complacency becoming an increasingly significant concern in maritime accidents, the National Maritime Occupational Health and Safety Committee, in co-operation with the UK Chamber of Shipping, Nautilus International and the RMT[23] union, produced *'Guidelines to Shipping Companies on Behavioural Safety Systems'*. The guidelines defined complacency as *'a feeling of calm satisfaction with your own abilities or situation that prevents you from trying harder".* Behavioural safety is a process of improving safety performance through changing the way people behave. Its application develops a culture where:

- Crew members take responsibility for their own and each other's safety.
- Unsafe acts and conditions are not tolerated.

The guidelines outline an effective SMS, including robust policies, systems and procedures that are considered key pre-determinants for the success of a behavioural safety system. This includes the avoidance of micro-management and the buy-in of the crews through the commitment to implement health and safety policies. The guidelines also detail elements and criteria by which the safety system should work, and aim to:

- 'Promote the safety, health and welfare of seafarers
- Reduce accidents and unsafe occurrences on board
- Eliminate complacency
- Develop a culture in which crew members take responsibility for their own and each other's safety and are prepared to challenge, and be challenged by, their colleagues
- Encourage safe behaviours through positive reinforcement (praise)
- Eliminate unsafe behaviours through an effective review process
- Give a clear conduit for improvement and correction of barriers to safe behaviour.'

Key principles of behavioural safety include:

- 'Behaviourism proposes that behaviour can be influenced through consequences
- A behaviour which is followed by a "positive reinforcement" will be repeated
- A behaviour which is followed by a "negative reinforcement" will cease in time
- Positive reinforcement has been found to be more powerful than negative reinforcement.'

[23] National Union of Rail, Maritime and Transport Workers

System success depends on:

- 'Commitment
- Leadership
- Peer pressure
- Co-operation within and across teams
- Openness
- Inter-dependent safety culture.'

The International Shipping Federation has also published a document on the understanding, and development of, a safety culture **(Annex D)**.

## 1.12 SIMILAR ACCIDENTS

A review of MAIB's database for accidents involving cigarettes and fires in the accommodation spaces of ships and fishing vessels, found 17 recorded incidents. Eight involved fires in bins where cigarettes had not been properly extinguished. Six involved fires in cabin bunks, resulting from crew, passengers or contractors smoking in bed. One such incident, which also involved alcohol and resulted in a fatality, featured in an edition of the MAIB's *Safety Digest* publication **(Annex E)**.

MAIB's database also identified a considerable number of accidents involving the failing or misapplication of a vessel's SMS. This is a frequently causal factor. Examples include:

*Clonlee*[24]

The report conclusions included:

"*Inadequate oversight and management of Clonlee's operations by the company had allowed non-compliant navigational practices to become routine.*

*Clonlee's SMM was generic in nature and did not accurately reflect the working practices required of the crew by the company, or the machinery and equipment fitted on board the vessel.*

*The general reluctance to take corrective actions to address points raised in audit observations, and react only to formal non-conformity notes, indicates that a weak safety culture existed within the company.*

*The Isle of Man Ship Registry had identified several of the contributory factors that led to Clonlee's grounding during previous ISM audits, but failed to raise non-conformity notes because they had been applying different definitions to those contained in the ISM Code.*"

[24] http://www.maib.gov.uk/publications/investigation_reports/2012/clonlee.cfm

*Ville de Mars*[25]

The report conclusions included:

> *"The precautions taken before the chief officer's entry into the tank fell significantly short of the requirements of the vessel's procedures, the expectations of the vessel's managers and industry practice.*
>
> *The repeated failure to issue permits to work for enclosed spaces and the failure to take the precautions detailed on the permits on the occasions they were issued, clearly indicates that the permit to work system on board Ville de Mars was ineffective.*
>
> *The action taken following the identification of a failure to use the permit to work system paid lip-service to the audit process and allowed the underlying problem to remain unaddressed.*
>
> *Complacency at all levels led to important safety procedures being disregarded on board Ville de Mars. Work is required to find ways in which a positive safety culture can be successfully instilled in ships' crews."*

[25] http://www.maib.gov.uk/publications/investigation_reports/2009/ville_de_mars.cfm

# SECTION 2 - ANALYSIS

## 2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

## 2.2 FATIGUE

Although AB2's consumption of alcohol was probably contributory to him falling asleep in his cabin bed, there is no evidence that he was suffering from work-related fatigue.

## 2.3 THE FIRE

### 2.3.1 Seat of the fire

Investigation of AB2's cabin indicated that the fire started at the aft end of the sofa, near the bed, and was probably caused by a lit cigarette that melted the sofa's vinyl covering and ignited the foam seating beneath. With a blanket on the sofa, and an open porthole located above the sofa, the resulting fire had a ready supply of fuel and oxygen.

### 2.3.2 Development

By the time AB2 had arrived on the bridge at 0317, the smoke from his cabin had already spread through the accommodation alleyway sufficiently for the 2/O to see it when he left the bridge and descended to Deck 2. The fire's speed of development was, by all accounts, rapid. This was not surprising given the fire load[26] in the cabin to support the fire.

Although protected to some degree by the vinyl covering, the sofa's upholstered foam seating was not fire-resistant. Consequently, as demonstrated in the fire tests conducted following the accident, once the foam was alight it burned quickly and gave off intense black smoke **(Figure 11)**.

In addition to the foam in the sofa and mattress, the cabin contained a plentiful supply of fuel to sustain the fire. In addition to the wood used to construct the furnishings, and AB2's clothing, a significant quantity of flammable products was also stored in the cabin. Some of these items were of a cosmetic nature normally found in a crew cabin, and the detonation heard by AB1 was probably caused by the explosion of an aerosol canister. However, by storing paint thinners in an undesignated plastic container in his cabin, AB2 had introduced fuel that significantly increased the chance of the fire becoming uncontrollable **(Paragraph 1.3.1)**. Although probably not a contributory factor in this case, the provision and use of a portable electric fan heater was an unnecessary fire hazard, particularly when the ship was at sea. Chapters 9 and 12 of COSWP provide appropriate advice on the dangers of portable heaters, spontaneous ignition, and the need for good housekeeping with regard to the storage and disposal of flammable products **(Paragraph 1.6.3)**. No alleyway lights were visible when AB1 opened his cabin

[26] The fire load represents the personal goods, furnishings, fixtures and fittings which affect the nature and spread of the fire, and possibly the stability of the surrounding structure.

door. The electrical circuit breakers for the lighting circuits were unlikely to have tripped before the fire had passed through AB2's 'M1000' insulated deckhead panel and then damaged the insulation of the electrical cables in the void space. As the electrical failure of the steering gear was not noticed until about 3 hours after the fire had started, it is concluded that the lighting circuit breakers probably had not tripped before AB1 evacuated his cabin, and that the reason he could not see the lights was because they were obscured by smoke.

During the early stages of the fire, the flow of air passing outside AB2 cabin's open porthole, probably acted to draw out the smoke in the cabin and so delayed the build-up of smoke in that space. This delay probably saved AB2's life. Nevertheless, the open porthole also assisted the fire's development by drawing in a steady supply of oxygen. The supply of oxygen would then have increased when AB2 left his cabin without closing the door properly behind him. Consequently, with plenty of fuel, a ready supply of oxygen and an environment in which temperatures could build rapidly, it was not surprising that flames quickly began to issue from AB2's porthole opening. On board *Celtic Carrier*, cabin portholes and internal doors were commonly left open because the vessel's accommodation ventilation system was unreliable and noisy, and was known to draw dust into the cabins. Instead of addressing the unsatisfactory operation of the system, the crew resorted to alternative measures to circulate air around the accommodation. Although successful, those measures increased the risk of oxygen exacerbating a fire, and allowed smoke and heat from a fire to readily spread. Failure to improve the installed heating and ventilation system also led to the introduction of portable electric fan heaters in the cabins, thereby introducing an additional fire hazard.

### 2.3.3 Smoking in bed and alcohol consumption

Although CMW required smoking areas to be designated on board its vessels, these had not been specified by the master. By only specifying locations where smoking was not allowed (ie the galley and mess room areas), the crew members who smoked were, in effect, given permission to smoke anywhere else in the accommodation. In this regard, it would have been reasonable to have specified crew cabins as designated smoking areas provided adequate safeguards were put in place, in accordance with the guidance provided in COSWP **(Paragraph 1.6.3)**.

While in his cabin on the evening of the fire, AB2 consumed between 6 and 8 units of alcohol, up to twice the company's specified limit of 4 units per day, in addition to his earlier consumption ashore. Alcohol consumption can affect judgment and reasoning and, therefore, influence decision-making. It is not known whether AB2 routinely smoked in bed but, on this occasion, it is probable that his consumption of alcohol influenced his decision to smoke in bed and almost certainly contributed to his falling asleep with a cigarette still lit. He was therefore extremely lucky that the resulting fire caused him sufficient pain to wake him, otherwise the fire would likely have claimed his life.

According to the ship's work schedule, AB2 should have been on watch at the time of the fire. Had he kept his assigned watches, and also complied with the SMS requirement not to consume alcohol within 8 hours of going on watch, the work schedule would have prohibited him from consuming alcohol at any time when the vessel was at sea. Instead, *Celtic Carrier* was proceeding on passage at night without a bridge lookout, contrary to the SMS and the guidance on watchkeeping regulations provided in MSN 1767(M) **(Paragraph 1.6.5)**, and with an intoxicated

crew member on board, contrary to the company's drug and alcohol policy. The extent to which alcohol was generally consumed on board is unknown. However, the commonplace practice of not posting bridge lookouts at night created an environment in which the ABs could drink, and be drunk, most evenings at sea.

Smoking in bed is dangerous at any time. Inadvertently allowing a lit cigarette to contact bedding can initiate a smouldering fire. The resulting smoke can cause drowsiness and asphyxiation before the fire is discovered. When alcohol is introduced the dangers are increased; a heightened level of carelessness, or disregard for the circumstances or location, can easily result in death. Although during seafarer training, and in various campaigns over many years, smoking in bed has been highlighted as a cause of shipboard fires and fatalities, it is clear that eradication of this dangerous pastime is not yet complete **(Annex E)**.

## 2.4 RESPONSE TO THE FIRE AND ALARM

### 2.4.1 AB2

It is probable that AB2's consumption of alcohol impaired his ability to wake up and then adversely affected his reaction to the developing fire. Further, his delay in waking meant that the fire was already well developed before he had an opportunity to react. However, his reaction on waking was poor. Prompt action in shutting the porthole, alerting other crew members by shouting and sending another crew member to the bridge to sound the fire alarm, and either then attacking the fire locally with a portable fire extinguisher **(Figure 16)** or closing the cabin door, might well have contained and potentially extinguished the fire. Such action is recommended in Chapter 10 of COSWP **(Paragraph 1.6.4)**. However, the effects of the alcohol and his burn injuries contributed to AB2's ill-preparedness to respond effectively to the emergency. Consequently, his reaction to the sudden stress of the situation was to throw an already burning blanket at the fire and run from his cabin to the bridge, leaving the door open.

### 2.4.2 The other crew members

By the time the fire alarm had been sounded on the bridge and other crew members had been alerted, the alleyway on Deck 2 had filled with smoke. In accordance with MGN 71(M) **(Paragraph 1.6.2)**, the Emergency Muster List required the crew to muster with warm clothing and their lifejackets to hand. Although some considered there was sufficient time to dress before evacuating their cabin, none of them took a lifejacket, and AB1 considered it safer to evacuate through his open cabin porthole than via the alleyway. No one considered using an EEBD to assist their breathing, and no attempt was made by anyone to activate the remote emergency ventilation fan stop adjacent to the 2/O's cabin or to close the open held back internal doors in an attempt to contain the fire **(Figure 1)**.

Sleep inertia can cause a dip in motor and cognitive performance after being woken abruptly, especially from a deep sleep, and this does not equip individuals well to cope with stressful, emergency situations. However, the shortcomings in their evacuation procedures indicate that *Celtic Carrier*'s crew were ill-prepared for the emergency.


**Figure 16:** Deck 2 starboard alleyway - post fire showing fire extinguisher and EEBD

## 2.5 FIRE PROTECTION AND FIRE-FIGHTING EQUIPMENT

Although the fire in AB2's cabin had a ready supply of fuel and oxygen, *Celtic Carrier*'s B15 structural fire protection arrangements were sufficient to contain the fire largely to within the one cabin. AB1 found evidence of this during the second re-entry when he found the motorman's cabin and his own had sustained only limited damage **(Paragraph 1.2.7)**. What damage there was at that time was possibly as a result of the fire travelling from AB2's cabin via the ventilation ducting connecting the cabins in the void space above the M1000 deckhead.

With the exception of the items listed below, the fire-fighting equipment provided on board *Celtic Carrier* met the regulatory requirements, and all of the equipment used during the emergency operated satisfactorily.

During the investigation, the following differences between the fire-fighting equipment shown on the ship's fire plan and that required by The Merchant Shipping (Fire Protection – Large Ships) Regulations 1998 were noted:

1. Two, rather than three firemen's outfits.

2. A 50kg wheeled dry powder fire extinguisher rather than a 45 litres capacity foam fire extinguisher or sufficient number of 16kg $CO_2$ fire extinguishers in the engine room.

3. No foam applicator in the engine room.

However, it is unlikely that the above differences were relevant to the outcome of the accident.

## 2.6 COMMAND AND CONTROL

Although, with the exception of the master, *Celtic Carrier*'s crew mustered on the poop deck, the opportunity was not taken to gather as much information about the fire as possible. Without a clear understanding of the extent of the fire, its possible cause, the status of doors and openings, and any fire-fighting attempts already undertaken, any plan to fight the fire would have been sub-optimal and could, potentially, have put lives at risk. The command and control structure for dealing with an emergency, as set out in the Emergency Muster List **(Figure 12)**, was not implemented, and the leadership expected from the master and chief officer for planning and executing the fire-fighting effort, was lacking. Instead of acting as a messenger to aid communication, and assisting AB1 to don a firemen's outfit, as specified in the Emergency Muster List, the 2/O initially took charge of the fire-fighting response, though he later took on a fire-fighting role himself.

The master remained on the bridge during the fire-fighting effort, but did not use the operational checklist intended to assist him with command and control in the event of a fire **(Paragraph 1.8.8)**. Decisions on various aspects of the fire-fighting response appear to have been made collectively by the crew grouped on the poop deck. The 2/O's decision to activate the EPIRB, which was soon afterwards cancelled by the master **(Paragraph 1.2.8)**, and the apparent lack of feedback from AB1 about the status of the fire in AB2's cabin following the second re-entry **(Paragraph 1.2.7)**, both serve to highlight the confused command and control structure on board.

There were similar shortcomings in raising the alarm with external authorities. Although the members of CMW's Emergency Response Team were on call 24 hours a day, the team was not contacted by the master until nearly 6 hours after the start of the fire, at which point he was mistakenly under the impression that the fire had been extinguished. Furthermore, Tarifa MRCC was not contacted until the crew had begun the process of abandonment following the fire's re-ignition and the master had been told that it was out of control. By not communicating with CMW's Emergency Response Team and Tarifa MRCC at an early stage, the master denied himself valuable external support, which could have included the precautionary deployment of assets to assist with the emergency response. This unwillingness to involve the authorities reflected the reluctance to report hazardous occurrences.

CMW's internal audit of *Celtic Carrier* carried out on 30 November 2012 identified that no hazardous occurrences had been reported in the previous year **(Paragraph 1.9.8)**.

## 2.7 FIRE-FIGHTING

Once *Celtic Carrier*'s crew had mustered, the initial actions to counter the fire were appropriate, including stopping the accommodation ventilation fans, closing the ventilation fire dampers, laying out fire hoses and starting the fire/ballast pump for boundary cooling.

However, the use of an over-side stage from which to feed a fire hose through the porthole opening from AB2's cabin was risky and could have ended in tragedy had AB1 fallen as he was wearing neither a safety harness nor a lifejacket. Although AB1's effort was commendable, the 2/O's tolerance of the risk reflected both his inexperience and the lack of leadership from more senior personnel.

Although the motorman was one of the designated firemen on the Emergency Muster List, and had previously undertaken advanced fire-fighting training, he had not worn a BA set since joining the vessel, and was not asked to do so on 26 April 2013. That he and other crew members were reluctant to don a firemen's outfit further demonstrates that the crew were ill-prepared for the emergency. Consequently, although the fireman's suit was too small for him, the 2/O decided to take on the task of the second firefighter so that an attack could be made on the fire.

Due to the high temperatures and thick smoke encountered, the 2/O and AB1 did not progress to AB2's cabin and extinguish the fire during the first re-entry. In view of their limited air supply, it was prudent for them to retreat when they did. However, as they withdrew from the scene of the fire they should have taken the opportunity to close the internal doors to attempt to contain the fire.

Further sub-standard fire-fighting techniques were employed before and during the second re-entry, which put the lives of the 2/O and AB1 at unnecessary risk. Firstly, the decision to open up and re-ventilate the accommodation less than 3 hours after the first re-entry and based on incomplete knowledge of the status of the fire, was questionable. Secondly, although restarting the ventilation made the second re-entry easier in terms of increased visibility and reduced temperature, it increased the risk that the fire might re-ignite. Thirdly, the re-entry was conducted without a fire hose, leaving the team without the means to fight any remaining fire, cool down any hot spots, or protect themselves by using a waterwall in the event of the fire re-igniting. The same issue had also been previously identified during an assessed training activity conducted on board *Celtic Carrier* in 2009 **(Paragraph 1.5.5)**. Fourthly, the 2/O decided to leave AB1 and collect his laptop from his cabin, and then return to the poop deck independently, notwithstanding that they were still in a live fire scene, with the potential for a sudden re-ignition.

As the 2/O and AB1 had not taken a fire hose with them, they were not in a position to address the considerable heat they found emanating from AB2's cabin. AB1's decision to open the motorman's cabin door was also ill-considered as with the cabin porthole closed ventilation into the space was limited to the gap between the bottom of the door and the door step. The act of opening the door introduced the possibility of a backdraught **(Paragraph 1.7)** occurring without any means readily available with which to rapidly cool the space within. The fire damage later

found to the motorman's cabin door jamb indicates that AB1 did not close the door properly following his inspection **(Paragraph 1.3.1)**. A second fire would appear to have broken out in the motorman's cabin less than 2 hours later, almost certainly as a result of the re-ventilation. Chapter 10 of COSWP makes clear the need for precautions to be taken to prevent a fire's spontaneous re-ignition **(Paragraph 1.6.4)**.

It is unknown why the discovery that considerable heat was emanating from AB2's cabin during the second re-entry was not reported to the master. Such a report might have triggered a decision to make a further re-entry to properly extinguish the fire.

Although it was subsequently reported to the master that the fire was out of control following its re-ignition in the motorman's cabin, there was no apparent reason why the fire could not have been brought under control by means of a further fire-fighting effort via the accommodation. The ship's fire-fighting equipment was still available, including the fire/ballast pump and plenty of spare BA air cylinders **(Paragraph 1.5.4)**.

## 2.8 FIRE-FIGHTING FAMILIARISATION AND TRAINING

Given that *Celtic Carrier*'s structural fire protection arrangements were sufficient to contain the fire, and that the fire-fighting equipment used operated satisfactorily, the reason for the fire not being promptly extinguished was that the crew were ill-prepared to deal with the emergency.

All of the crew had undertaken the mandatory STCW training in fire prevention and fire-fighting, and the officers and the motorman had also undertaken advanced training in controlling fire-fighting operations. Furthermore, in accordance with MGN 71(M) **(Paragraph 1.6.2)**, all of the crew had undergone safety familiarisation on joining *Celtic Carrier* and all had signed the fire training manual. Notwithstanding these actions, their familiarity with standard evacuation and fire-fighting techniques, and willingness to don a BA set, were not evident.

In accordance with MGN 71(M), an Emergency Muster List had been prepared and was posted at various locations around the ship. Although it included each crew member's duties in the event of a fire, it did not make provision for a substitute in the event of a crew member being unable to carry out their duties. Therefore, no one was nominated and trained to substitute for the motorman when he was unwilling to don a firemen's outfit. It also meant that the firemen's suit was not guaranteed to fit anyone other than the motorman; in this case, the 2/O.

In accordance with MGN 71(M), and reiterated in CMW's SMS **(Paragraph 1.8.8)**, *Celtic Carrier*'s crew were required to conduct and record an emergency fire drill at least once every month. MGN 71(M) additionally advises that a fire drill should, as far as is practicable, be conducted as if it were a real emergency, with water being played through fire hoses and at least one portable fire extinguisher being discharged by a different crew member at each drill. It also recommends that, on cargo ships with small crews, every crew member should be familiar with all aspects of fire-fighting and the use of all fire-fighting equipment on board.

The fire drill conducted on 23 January 2013 was one of four drills conducted over a period totalling only 1 hour and 45 minutes **(Paragraph 1.5.5)**. The fire drill conducted on 21 February 2013 lasted approximately 15 minutes and did not involve a simulated exercise. No further fire drills were conducted before the accident on 26 April 2013. The operational emergency checklist to assist with command and control in the event of a fire had apparently not been used since 16 November 2012 **(Paragraph 1.8.8)**. The one-line entries made in *Celtic Carrier's* Official Log Book to record the emergency drills conducted on board **(Figure 13)** did not contain the detail promoted in the MCA's publication *'A Master's Guide to the UK Flag'* **(Annex A)**, and the *'Fire Drill Report'*s and *'Safety and Security Committee Meeting Report'*s contained similar or identical remarks.

The investigation also identified omissions and inconsistencies with respect to the conduct and recording of other emergency drills, and the inspection and maintenance of safety equipment on board. Of particular concern was the falsification of some emergency drill entries in the Official Log Book **(Figure 13)**, which calls into question the validity of other records held on board.

Emergency fire drills are a mandatory requirement for very good reasons, so to wilfully disregard or trivialise them, and engage in deliberate falsification, demonstrates that a complacent approach to safety existed on board. Whether that complacency had recently developed or was more longstanding is unclear. Nevertheless, the consequent decision not to conduct regular, thorough drills on board *Celtic Carrier* had the potential to put the crew's lives at risk.

Of further concern was that AB2 had not used a portable fire extinguisher since attending a fire-fighting training course in 2010 **(Paragraph 1.5.5)**. This suggests that emergency fire drills conducted on his three previous CMW vessels might have been of a similar rudimentary nature to those conducted on *Celtic Carrier*, and that complacency might have been more widespread across CMW's fleet. This conclusion is supported by similar issues highlighted during recent SMC audits conducted on other UK-flagged CMW ships **(Paragraph 1.9.5)**.

The above fire-fighting shortcomings demonstrate a lack of the investment of time and effort normally required to undertake thorough, meaningful, fire drills. Regular, comprehensive fire-fighting training would have given the crew confidence to promptly deal with this fire. Emergency drills teach not only the practicalities of dealing with different types of emergency situation, but also important management techniques, including leadership and teamwork. These valuable skills cannot be achieved through falsifying records.

## 2.9 SMS MANAGEMENT REVIEW

In accordance with the IMO's approved guidelines for the operational implementation of the ISM Code, a company should periodically evaluate the effectiveness of its SMS. The evaluation should take into account the results of internal audits, masters' reviews, analysis of reported non-conformities, accidents and hazardous occurrences, and any other evidence of possible failure of the SMS such as PSC inspection reports **(Paragraph 1.6.6)**.

A review of *Celtic Carrier*'s PSC inspection history from 2009 until the accident identified a range of fire safety and ISM Code related deficiencies **(Paragraph 1.9.1)**. Although CMW contracted a company to provide training to the crew of *Celtic Carrier* in fire-fighting and emergency preparedness on 9-10 January 2009, no further training of this type was carried out on the ship before the accident.

SMC audits of the other UK-flagged CMW vessels by the MCA up to 3 February 2012 also highlighted general crew unfamiliarity with the SMS and regulatory requirements, including: unclear and falsified recording of emergency drills and safety equipment maintenance; lack of command and control, and non-use of the operational emergency checklist during fire drills; sub-standard fire-fighting techniques and use of equipment; lack of hazardous incident reporting; and no bridge lookout posted at night **(Paragraph 1.9.5)**.

The MCA's report summary of its SMC audit of *Celtic Carrier,* conducted on 18 April 2012, identified a number of missing compulsory Official Log Book entries and made a recommendation to CMW to provide information and training to its masters on Official Log Book entry requirements. The summary suggested that the large number of PSC inspections and associated deficiencies raised the risk that the ship would be detained on grounds that the SMS was not working. It further stated that there was a need to promote onboard deficiency monitoring and indicated that NCNs should be raised by ship's staff when appropriate. The summary also highlighted that the bridge logbook did not have a lookout entry to cover the period between 0600 and sunrise **(Paragraph 1.9.4)**.

Consequently, following the MCA's SMC audit of *Celtic Carrier* on 18 April 2012, CMW was aware of a number of common SMS issues that needed to be addressed both ashore and across its fleet.

A change to CMW's SMS to require NCNs to be raised by ship's staff, in accordance with the spirit of the ISM Code, would have empowered the master, and encouraged him and other members of the crew, to more fully engage with the SMS. This might then have generated a dialogue between the master and the DPA with regard to shipboard concerns over the unreliability, noise and dust associated with the accommodation ventilation system, and the resulting perceived need to keep internal doors and cabin portholes open. It might also have encouraged the master to express to the DPA his view that the scope of other work required of AB1 and AB2 meant that it was necessary for them to forego bridge watchkeeping duties in order that they gained sufficient rest. It might also have prompted the master to express to the DPA his opinion that, owing to the ship's work schedule, there was insufficient time to conduct all of the required emergency drills. An SMS reference to the IMO guidelines to encourage the reporting of near-miss occurrences might have triggered greater ship/shore transparency and resulted in earlier notification of the fire to CMW and the MRCC on the day of the accident.

Instead, CMW's shore management continued to accept the veracity of *Celtic Carrier*'s records without critical examination. Although its internal audit of *Celtic Carrier* on 30 November 2012 highlighted the fact that no hazardous incidents had been reported in the previous year, no exploratory or corrective action was taken. Furthermore, an NCN referring to safety rounds raised during that audit was later closed out without appropriate corrective action being taken in accordance with its own SMS procedures.

CMW viewed the results of the audits and inspections as a reflection of the decreasing quality of the crews it was employing in an industry within which it was increasingly difficult to operate and survive economically. CMW responded by taking a micro-management and authoritarian approach to the operation of its ships, which was tacitly confirmed by an MCA audit report referring to a company blame culture **(Paragraph 1.9.5)**. It is apparent that CMW's shore management did not completely recognise the need to fully involve its crews in the application of the SMS to ensure its success. Instead, its management style had the effect of reducing the interest and engagement of its crews, made the SMS harder to implement as a result, and probably contributed to the falsification of shipboard records. Indeed, it appears CMW applied the SMS solely as a means of limiting the scope for PSC detentions and deficiencies rather than as a way of developing shore management and shipboard staff into a cohesive, efficient unit.

The above shortfalls demonstrate that CMW had not yet developed a robust safety culture both ashore and across its fleet. Appropriate advice for developing such a culture is provided in the National Maritime Occupational Health and Safety Committee's publication *Guidelines to Shipping Companies on Behavioural Safety Systems'* and the International Shipping Federation's document on the understanding, and development, of a safety culture **(Annex D)**.

## 2.10 MARITIME AND COASTGUARD AGENCY AUDITS

A probable contributing factor to CMW not taking action to address the common issues that existed ashore and across its fleet was that no related non-conformities or observations were raised against the company as a result of the MCA's SMC audit of *Celtic Carrier* on 18 April 2012 and the DoC audit of CMW on 30 May 2012 **(Paragraphs 1.9.4 and 1.9.6)**. Furthermore, the report summary of the DoC audit made no reference to the issues identified in the summary report of *Celtic Carrier*'s SMC audit, and stated that, subject to the DoC audit findings, the SMS met the necessary requirements **(Paragraph 1.9.6)**.

*Celtic Carrier* had been subject to the ACS since 2007. The fact that the ship no longer met two of the ACS eligibility criteria relating to PSC inspection performance should have merited scrutiny of the deficiency areas identified and prompted a review of whether or not it was appropriate for *Celtic Carrier* to remain in the ACS **(Paragraph 1.9.7)**. However, no formal exit criteria were in place to cover this eventuality, and *Celtic Carrier*'s PSC inspection record, highlighted in the report summary of *Celtic Carrier'*s SMC audit, was not treated with the concern it deserved. The issues identified during the MCA's SMC audits of other CMW ships were very similar to the deficiencies found on board *Celtic Carrier* during PSC inspections over a number of years, many of which were indicative of an ineffective SMS and gave the MCA sufficient warning of potential underlying issues.

The MCA operated a paper-based system for monitoring its ISM Code audit activity, that involved the Marine Offices raising and closing out NCNs and sending the audit reports and NCNs to the MCA headquarters. The system made it difficult for an MCA surveyor who was not familiar with the vessel or company to gain a comprehensive overview of the audit and inspection history of a company and its fleet before conducting a scheduled SMC or DoC audit. Furthermore, the lack of a national database for ISM Code audits hampered the MCA's ability to conduct fleet performance trend analysis, and to ensure that a consistent approach to auditing was carried out **(Paragraph 1.9.3)**.

Although a review of the audit and inspection history of the company and its fleet was undertaken prior to the SMC audit of *Celtic Carrier* on 18 April 2012, the MCA's ISM Code instructions for the guidance of surveyors do not currently require this prior to conducting an SMC audit. However, in respect of a DoC audit, they include a requirement to examine the reports of internal audits of offices and ships, the follow-up of corrective action and closing out of non-conformities, and reports of inspections of ships. In CMW's case, this should have highlighted the common SMS issues across its UK-flagged fleet and prompted the MCA surveyors to pay particular attention to those areas.

The report summary of CMW's DoC audit on 30 May 2012 identified a number of issues, including the lack of a marine superintendent, which was still the case at the time of *Celtic Carrier*'s accident. However, as the report did not take account of, and reiterate, the issues identified in the summary report of *Celtic Carrier*'s SMC audit on 18 April 2012, an opportunity was missed to reinforce the need for CMW to address those issues as a matter of priority.

# SECTION 3 - CONCLUSIONS

## 3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. AB2 fell asleep holding a lit cigarette, which melted the vinyl covering of his cabin sofa and ignited the foam seating beneath. Designated smoking areas had not been specified by the master, which gave tacit permission for the crew to smoke in their cabins. [2.3.1, 2.3.3]

2. The sofa's upholstered foam seating was not fire-resistant. Consequently, once alight, the foam burned quickly and gave off intense black smoke. [2.3.2]

3. Cabin portholes and internal doors were commonly left open, which assisted the fire's development by providing a ready supply of oxygen. [2.3.2]

## 3.2 OTHER SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT

1. AB2's consumption of alcohol probably influenced his decision to smoke in bed on this occasion and contributed to his falling asleep holding a lit cigarette, which melted the vinyl covering of his cabin sofa and ignited the foam seating beneath. [2.3.1, 2.3.3]

2. There was a sufficient quantity of flammable products stored in AB2's cabin to ensure that the fire was readily supported. The danger of storing an undesignated plastic container of paint thinners in a cabin was evidently not understood or managed. [2.3.2]

3. It is probable that AB2's consumption of alcohol impaired his ability to wake-up and then adversely affected his performance in reacting to the developing fire. [2.4.1]

4. Although all crew members would have experienced an initial dip in their performance from having woken up and the stressful situation in which they found themselves, they were nevertheless ill-prepared for the emergency. [2.4.1, 2.4.2, 2.6, 2.7, 2.8]

5. The necessary leadership expected from the master and chief officer for planning and executing the fire-fighting effort was missing and resulted in a confused command and control structure on board. [2.6, 2.7]

6. Sub-standard fire-fighting techniques resulted in internal doors not being closed and crew members being unnecessarily exposed to the possibility of a backdraught and spontaneous re-ignition of the fire. [2.7]

7. The records of some emergency drills in the Official Log Book were falsified, which calls into question the validity of other records and demonstrates that a complacent approach to safety existed on board. [2.8]

8. The Emergency Muster List did not make provision for a substitute in the event of a crew member being unable to carry out their duties. [2.8]

## 3.3 SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. The provision and use of a portable electric fan heater in a cabin was an unnecessary fire hazard, particularly when the ship was at sea. [2.3.2]

2. Similar safety issues to those identified on *Celtic Carrier* highlighted during recent SMC audits conducted on other UK-flagged CMW ships, suggest that complacency might have been more widespread across CMW's fleet. [2.8]

3. Although CMW was aware of a number of common SMS issues that needed to be addressed both ashore and afloat, its shore management continued to accept the veracity of *Celtic Carrier*'s records without critical examination, and viewed the results of audits and inspections as a reflection of the decreasing quality of the crews it was employing to operate and survive economically. [2.9]

4. In taking a micro-management and authoritarian approach to the operation of its ships, it is apparent that CMW's shore management did not fully recognise the need to fully involve its crews in the application of the SMS to ensure its success, and demonstrates that the company had not yet developed a robust safety culture both ashore and across its fleet. [2.9]

5. The MCA's ISM Code instructions for the guidance of surveyors currently do not require the findings of previous audit and PSC inspection reports for a company and its UK-flagged ships to be reviewed prior to conducting an SMC audit. [2.10]

6. The fact that *Celtic Carrier* no longer met two ACS eligibility criteria, did not prompt a review of the ship's continued eligibility because no formal exit criteria were in place to cover this eventuality. [2.10]

7. The MCA's paper-based system for monitoring its ISM Code audit activity meant that a comprehensive overview of the audit and inspection history of a company and its fleet by an MCA surveyor unfamiliar with that company or ship, was not always feasible before conducting a scheduled SMC or DOC audit. [2.10]

8. The lack of a national database for ISM Code audits hampered the MCA's ability to conduct fleet performance trend analysis, and to ensure that a consistent approach to auditing was carried out. [2.10]

9. As the report summary of CMW's DoC audit on 30 May 2012 did not take account of and reiterate the issues identified in the summary report of *Celtic Carrier*'s SMC audit on 18 April 2012, the MCA missed an opportunity to reinforce the need for CMW to address those issues as a matter of priority. [2.10]

## 3.4 OTHER SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT

1. It was commonplace for bridge lookouts not to be posted at night despite company instructions to do so. [2.3.3]

2. There were differences between the fire-fighting equipment shown on the ship's fire plan and that required by applicable regulations. However, it is unlikely that the differences were relevant to the outcome of the accident. [2.5]

## SECTION 4 - ACTION TAKEN

**CMW** has:

- Banned smoking in crew cabins.
- Introduced designated shipboard smoking areas.
- Extended externally provided fire-fighting training across its UK-flagged fleet.
- Introduced enhanced requirements for recording emergency drills.
- Updated its SMS Safety Planned Maintenance Schedule to include lubrication of accommodation fire doors.
- Circulated a fleet memorandum requiring the closing of accommodation fire doors at night.
- Removed portable electric fan heaters from its ships.
- On *Celtic Carrier*, replaced the foam mattresses and sofa upholstery foam with fire-resistant alternatives.
- Introduced a requirement for masters to spend 6-8 weeks in the company's head office to gain an appreciation of its systems and procedures.
- Contracted an independent auditor to analyse all of CMW's internal inspections and audits, and to develop a process to highlight recurring problems.

The **MCA** has:

- Carried out a general inspection of *Celtic Carrier*.
- Introduced a requirement for its surveyors to notify the MCA's headquarters of the closure of all non-conformities, and reiterated the importance of forwarding audit reports to its headquarters in a timely manner.
- Instructed 10% of all DoC/SMC audit files to be sent to the ISM Branch at the MCA's headquarters for review to ensure consistency and adequacy.

## SECTION 5 - RECOMMENDATIONS

**Charles M Willie & Co. (Shipping) Ltd** is recommended to:

2014/129 Take appropriate steps to ensure that its masters and crews understand the potential consequences of failing to undertake emergency drills and of falsifying official records, and put in place measures to minimise the opportunities for doing so.

2014/130 Review and revise its internal audit process to ensure that ISM Code related deficiencies are:

- Properly considered by its masters and crews.
- Robustly addressed with sound evidence to support the action taken to rectify them.
- Considered at both individual ship and fleet wide levels to ensure that any trends in deficiencies are identified quickly.

2014/131 Taking into account the IMO's approved guidelines for the operational implementation of the ISM Code and near-miss reporting, and the National Maritime Occupational Health and Safety Committee's *'Guidelines to Shipping Companies on Behavioural Safety Systems'*, review and revise its SMS and crew training requirements to:

- Ensure that crews are fully capable of being involved in meeting the requirements of the ISM Code.
- Establish a company safety culture that empowers and encourages crews to identify and report non-conformities and hazardous incidents, and propose improvements to the company's safety management system.

**The Maritime and Coastguard Agency** is recommended to:

2014/132 Consider and, where necessary, adapt its procedures for ISM Code related audits to ensure that:

- Any serious shortcomings that are found during audits in respect of 'non-conformities' and 'observations' are consistently documented in an appropriate and proportionate manner and that 'non-conformities' are only cleared after acceptance of reasonable evidence that the underlying problem has been corrected.
- The results of ISM Code related surveys and audits conducted in respect of a company and each of its UK-flagged ships are reviewed on a periodic basis, and prior to conducting an SMC audit of one of those ships, or a DoC audit of the company, to assess the company's safety management performance.
- The PSC inspection history of a ship is reviewed prior to conducting an SMC audit of that ship.
- Positive action is taken by the MCA to inform companies whose safety

management performance is not meeting the required standard, or where audits have detected areas of serious concern, and for the MCA to consider instigating a formal process with them to improve performance where such cases have been identified.

2014/133 Expedite the delivery of the existing information management software project to improve the performance and efficiency of information management, replacing the current paper-based system for monitoring its ISM Code audit activity.

2014/134 Review its application of the Alternative Compliance Scheme to ensure that ships within the scheme are compliant with the eligibility criteria.

Extracts from A Master's Guide to the UK Flag

Maritime and Coastguard Agency

# A Master's Guide to the UK Flag


5 October 2009

- The interval between consecutive periods of rest shall not exceed 14 hours; and

- The minimum hours of rest shall not be less than 77 hours in any 7 day period.

2.1.2 Situations when a seafarer is on call but is free to sleep may be counted as rest, but if at any time the normal period of rest is disturbed by call-outs to work the Master, or a person authorised by him, has to ensure that the seafarer is provided with an adequate compensatory period of rest.

## 2.2 UMS

The time when the designated duty engineer officer in a ship with a UMS class notation is free to sleep may also be counted as "rest". However, any time that the officer is called to answer an alarm condition has to be considered as work and as a break in that rest and when that happens the amount of rest due to him has to be recalculated.

## 2.3 Hours of Rest Schedule

2.3.1 Your ship should have an "Hours of Rest Schedule". This is a document, or a computer display, that has been drawn up by the owner or manager (whoever is responsible for operating the ship) in conjunction with the Master. It has to show the maximum watch periods and minimum rest periods to be observed by all crew members.

2.3.1 The "operator" cannot change this document without consulting with yourself as Master. The operator has a duty to ensure that sufficient personnel are provided so that the rest periods can be complied with. The "hours of rest schedule" or an accurate print out of it if it is kept as a computer file, must be posted up in a prominent place on board accessible to all the crew. Port State Control Officers, and United Kingdom Surveyors, will expect to see this when they come on board and will record a deficiency if it is not available and posted up.

## 2.4 Records

2.4.1 Accurate records of hours of rest should be maintained one copy should be held by the Master and a copy given to the seafarer.

2.4.2 Any deviations from the hours of rest in the schedule must be recorded with an explanation of why the deviation occurred. These records must be available for inspection on board at any time. You can decide where the deviations are recorded and you can use any method that is effective provided that the records are available.

## 2.5 'Properly rested'

The regulations place a duty on the Master to ensure that all crew involved in watch keeping are properly rested and that arrangements are adequate to maintain a safe watch at all times. You are required to ensure that your ship does not sail from any port unless the officers in charge of the watch immediately after sailing have received sufficient rest to allow them to maintain a safe watch.

## 2.6 Exceptions

2.6.1 There will obviously be times such as:

- Emergencies and situations likely to become emergencies unless action is taken,
- Musters and drills,
- Essential work on board which cannot be delayed for safety or environmental protection reasons; and
- Factors beyond the control of the Master or the operator other than commercial needs.

2.6.2 When these things occur it is often necessary for crew members who are involved to miss out on their minimum rest as stated in the schedule. You have the authority as Master to permit this but you must record the fact and the reason for them, for missing out on the minimum rest for those men affected.

2.6.3 In deciding what factors might come within “factors outside the control of the Master or the operator other than commercial needs” you will need to take into account the circumstances. The definition was written to take account of situations such as when a Port Authority demands that the ship vacate the berth when you had planned to stay longer, or when a shift of berth is demanded unexpectedly. On the other hand a request by the charterer to sail earlier so that he may minimise port dues is not a valid factor under this definition and counts as a commercial need.

## 2.7 Leave

The regulations state that a seafarer is entitled to paid annual leave of at least four weeks, or a proportion of four weeks in respect of a period of employment of less than one year. This may be taken in instalments but may not be replaced by a payment in lieu, except where the seafarer's employment is terminated.

### 3.3 Terminating a crew agreement

3.3.1 At the end of the crew agreement it must be closed and all persons on it who have not already done so must sign off in section (b) of the final column while the master should ensure that all the other shaded boxes are completed. The entry for “Date and Place of leaving the ship” should be left blank if the crew member is to sign on another crew agreement immediately and is not therefore leaving the ship and, as noted above, the reason for discharge in this case will be “agreement terminated”.

3.3.2 As soon as a crew agreement is closed and another one opened, the old one complete with all its parts and including:

- Form ALC 1 - the cover.
- Form ALC(NFD)1(d) - the contractual clauses with any attached wage scales.
- Forms ALC1(a), (b), and (c) - the lists of crew.
- The completed Official Log Book, and
- Radio log books covering the period of the agreement.

Should be sent to your Customer Service Manager at the MCA.

By signing the crew agreement the crew member is agreeing to be bound by the 'Code of Conduct for the Merchant Navy'.

## 4 Official Log Books

**Cargo ships only -**

4.1 The Merchant Shipping (Official Log Book) Regulations 1981 make it a requirement for all United Kingdom ships (except fishing vessels, ships less than 25 tons, and pleasure vessels) to carry and keep an Official Log Book.

4.2 The Official Log Book (OLB) has guidance notes on the front cover that should be read along with these guidance notes. It is essential that all the relevant entries are fully completed. For example the absence of proper entries could prejudice the position of the Master in the event of an accident. It is an offence to fail to keep the Official Log Book or to make incorrect entries.

### Page 1 - Front cover

4.3 The first entries are simply the details of the ship, name, port of registry, official number, gross tonnage, and net tonnage. The details should be taken from the ship’s certificate of registry, noting that the official number is a unique British ship number; it is NOT the IMO number.

4.4 The second section is for the names of successive Masters of the ship. The Master opening the Official Log Book should enter his name and certificate details on the first line, successive Masters should add their details

**Pages 8 and 9 - Births and deaths**

4.12 Instructions for completion are at the top of the section. It should be noted that in the section for births, the signature of the mother is required while in the section for deaths, the signature of the master AND the signature of a member of the crew are both required. The crew member may be any crew member.

4.13 It is essential that the mother's signature is given in the case of a birth and essential that the entries in respect of deaths are signed by the master and by a crew member. A failure to sign and witness these entries can invalidate them and can cause serious legal problems.

4.14 The form MSF 4605 (formerly RBD.1) referred to is available at Annex 2, from the Registry of Shipping and Seamen or any Marine Office.

**Pages 10 to 14 - Record of musters, boat drills etc**

4.15 This section must be completed at the time of every drill. Attention is drawn to MGN 71 'Muster, drills, on-board training and instructions and Decision Support Systems'. This sets out the current requirements for the frequency of drills and content.

A typical entry will look like:

| Date of muster, drill, training, instruction or inspection. | Nature of muster drill, training, instruction or inspection. (including the condition in which the life-saving and fire appliances were found), and a record of the occasions on which the lifeboats were swung out and lowered | Date of entry | Signatures of master and member of crew |
|---|---|---|---|
| 02/01/05 | General alarm sounded, all crew mustered on Boat Deck for paint locker fire, fire pumps, breathing apparatus and paint locker sprinkler tested. Crew mustered for Abandon Ship stations. Davit launch liferaft training carried out. All equipment satisfactory | 02/01/05 | P Hatch Master<br><br>S Tanashchuk Chief Officer |
| 09/01/05 | General alarm sounded Crew mustered for Abandon Ship stations. Freefall lifeboat launched and recovered<br>All equipment satisfactory | 09/01/05 | P Hatch Master<br><br>S Tanashchuk Chief Officer |
| 11/01/05 | Weekly inspection of lifesaving appliances General alarm tested, freefall lifeboat and rescue boat engine run.<br>All equipment satisfactory | 11/01/05 | P Hatch Master<br><br>S Tanashchuk Chief Officer |

4.16 Every entry MUST be signed by the master and by one other crew member. If it is not signed by BOTH, the entry is invalid and will not be accepted as proof that the drills have been carried out.

4.17 If for any reason a muster or drill is not held then a statement as to the reason why should be entered in column 2. Valid reasons might include "vessel rolling and pitching heavily, unsafe to carry out drills".

4.18 If a drill is postponed or cancelled then it should take place at the next suitable opportunity.

4.19 An additional UK requirement is for Entry into Dangerous Spaces Drills. The master of:

(a) any tanker or gas carrier of 500 tons and over, and
(b) any other ship of 1000 tons and over

must ensure that drills simulating the rescue of a crew member from a dangerous space are held at intervals not exceeding two months, and that a record of such drills is entered in the Official Log Book.

**Pages 15 to 18 - Record of test drills and inspections of steering gear**

4.20 This section is self explanatory. The regulations require steering gear to be tested within 12 hours before sailing (or once per week for ships making one voyage or more per week from the same port) and emergency steering systems to be tested every 3 months.

Typical entries might appear as:

| Date, time and place of test drill, inspection or pre-sea check | Nature of Inspection, test drill or check of Steering Gear | Date of Entry | Signatures of master and officer |
|---|---|---|---|
| 02/03/05 1700 LT<br>Riverside Quay<br>South Shields | Steering gear tested Satisfactorily in all modes | 02/03/05 | P Hatch<br>Master<br><br>S Tanashchuk<br>Chief Officer |
| 15/05/05 1100 LT<br>54° 50´ N<br>01° 00´ E | Emergency steering gear tested, control from steering gear compartment and communications all satisfactory | 15/05/05 | P Hatch<br>Master<br><br>S Tanashchuk<br>Chief Officer |

4.21 As with most sections of the OLB all entries MUST be signed by the master and an officer to be valid.

**Pages 19 to 23 - Record of inspections of crew accommodation.**

4.22 This section is for records of mandatory inspections of crew accommodation. The regulations require that an inspection of the crew accommodation, to ensure that it is being kept clean and that all the requirements of the crew accommodation regulations are being followed, is carried out every 7 days. The inspection must be carried out by the master

**Annex B**

IMO Guidelines for the operational implementation of the ISM Code by companies

**INTERNATIONAL MARITIME ORGANIZATION**
4 ALBERT EMBANKMENT
LONDON SE1 7SR

Telephone: 020 7587 3152
Fax: 020 7587 3210

**IMO**

***E***

Ref. T2-HES/4.2
T5-MEPC/1.01

MSC-MEPC.7/Circ.5
19 October 2007

# GUIDELINES FOR THE OPERATIONAL IMPLEMENTATION OF THE INTERNATIONAL SAFETY MANAGEMENT (ISM) CODE BY COMPANIES

1 The Maritime Safety Committee at its eighty-second session (29 November to 8 December 2006) and the Marine Environment Protection Committee at its fifty-sixth session (9 to 13 July 2007) considered the report of the Group of Independent Experts on the impact of the ISM Code and its effectiveness in the enhancement of safety of life at sea and protection of the marine environment and agreed that guidelines and associated training should be developed to assist companies and seafarers in improving the implementation of the Code.

2 The Marine Environment Protection Committee at its fifty-sixth session (9 to 13 July 2007) and the Maritime Safety Committee at its eighty-third session (3 to 12 October 2007) further agreed that it was essential to review the existing guidelines and develop new guidelines to assist companies in effective and efficient operational implementation of the ISM Code.

3 Accordingly, the Committees approved the guidelines for operational implementation of the ISM Code by Companies as set out in the annex.

4 Member Governments and international organizations concerned are recommended to bring this circular to the attention of all parties concerned.

***

**ANNEX**

# GUIDELINES FOR THE OPERATIONAL IMPLEMENTATION OF THE INTERNATIONAL SAFETY MANAGEMENT (ISM) CODE BY COMPANIES

## 1 INTRODUCTION

### 1.1 The ISM Code

1.1.1 The International Management Code for the Safe Operation of Ships and for Pollution Prevention (International Safety Management (ISM) Code) was adopted by the Organization by resolution A.741(18) and became mandatory by virtue of the entry into force on 1 July 1998 of SOLAS chapter IX on Management for the Safe Operation of Ships. The ISM Code provides an international standard for the safe management and operation of ships and for pollution prevention.

1.1.2 The Maritime Safety Committee, at its seventy-third session, adopted amendments to chapter IX of SOLAS by resolution MSC.99(73), and to sections 1, 7, 13, 14, 15 and 16 of the ISM Code by resolution MSC.104(73).

1.1.3 The ISM Code requires that Companies establish safety objectives as described in section 1.2 of the ISM Code, and in addition that the Companies develop, implement and maintain a safety management system which includes functional requirements as listed in section 1.4 of the ISM Code.

1.1.4 The application of the ISM Code should *support and encourage* the development of a safety culture in shipping. Success factors for the development of a safety culture are, *inter alia***,** commitment, values and beliefs.

## 2 SCOPE AND APPLICATION

### 2.1 Definitions

The terms used in these Guidelines have the same meaning as those given in the ISM Code.

### 2.2 Scope and Application

2.2.1 These Guidelines establish the basic principles for:

.1 reviewing the safety management system by a Company;

.2 the role of the Designated Person under the ISM Code;

.3 reporting and analysing of non-conformities, accidents and hazardous occurrences (including near-misses); and

.4 performing internal audits and management reviews,

and do not reduce or replace the Company's responsibilities outlined in the ISM Code.

## 3 DEVELOPMENT OF THE SAFETY MANAGEMENT SYSTEM

3.1 The ISM Code requires that Companies establish safety objectives as described in section 1.2 of the ISM Code, and in addition that Companies develop, implement and maintain a safety management system (SMS) which includes functional requirements as listed in section 1.4 of the ISM Code.

3.2 Given the self-regulatory principles of the ISM Code, the internal verification and review processes are key elements in the implementation of each SMS. The Company should consider the outcome of internal audits, internal SMS reviews and analysis of non-conformities, accidents and hazardous occurrences to enhance the effectiveness of operations and procedures within their SMS. To comply with the Code, the Company should:

.1 designate a person or persons with direct access to the highest level of management who should monitor the safe operation of each ship (section 4);

.2 ensure that adequate resources and shore-based support are provided to enable the designated person or persons to carry out their functions (section 3.3);

.3 define and document the master's responsibility with regard to reviewing the safety management system and reporting its deficiencies to the shore-based management (section 5.1);

.4 establish procedures for reporting and analysis of non-conformities, accidents and hazardous occurrences (section 9.1);

.5 periodically evaluate the effectiveness of, and when needed, review the safety management system (section 12.2); and

.6 perform internal audits to verify whether safety management activities comply with the requirements of the safety management system (section 12.1).

## 4 DESIGNATED PERSON

4.1 A key role, as identified by the ISM Code, in the effective implementation of a safety management system is that of the Designated Person. This is the person based ashore whose influence and responsibilities should significantly affect the development and implementation of a safety culture within the Company.

4.2 The designated person should verify and monitor all safety and pollution prevention activities in the operation of each ship. This monitoring should include, at least, the following internal processes:

.1 communication and implementation of the safety and environmental protection policy;

.2 evaluation and review of the effectiveness of the safety management system;

.3 reporting and analysis of non-conformities, accidents and hazardous occurrences;

.4 organizing and monitoring of internal audits;

.5 appropriate revisions to the SMS; and

.6 ensuring that adequate resources and shore-based support are provided.

4.3 To enable the designated person to carry out this role effectively, the Company should provide adequate resources and shore-based support. These include:

.1 personnel resources;

.2 material resources;

.3 any training required;

.4 clearly defined and documented responsibility and authority; and

.5 authority for reporting non-conformities and observations to the highest level of management.

4.4 Designated Person(s) should have the qualifications, training and experience as set out in MSC-MEPC.7/Circ.6, to effectively verify and monitor the implementation of the safety management system in compliance with the ISM Code.

## 5 REVIEW OF THE SAFETY MANAGEMENT SYSTEM

5.1 The Company should, when needed, review and evaluate the effectiveness of the SMS in accordance with procedures established by the company. Further, it is one of the master's responsibilities to review the safety management system and to report its deficiencies to the shore-based management. Shore based and ship board internal audits should be performed at least once a year.

5.2 Management reviews support companies' efforts in achieving the general safety management objectives as defined in section 1.2.2 of the ISM Code. Based upon the results of such reviews, the Company should implement measures to improve further the effectiveness of the system. The review should be performed on a periodical basis or when needed, e.g., in case of serious system failures. Any deficiencies found during the management review should be provided with appropriate corrective action taking into account the Company's objectives. The results of such reviews should be brought to the attention of all personnel involved in a formal way. The management review should at least take into account the results of the internal audits, any non-conformities reported by the personnel, the master's reviews, analysis of non-conformities, accidents and hazardous occurrences and any other evidence of possible failure of the SMS, like non-conformities by external parties, PSC inspection reports, etc.

## 6 REPORTING AND ANALYSING OF NON-CONFORMITIES, OBSERVATIONS, ACCIDENTS AND HAZARDOUS OCCURRENCES

6.1 The SMS should contain procedures to ensure that non-conformities, observations and hazardous occurrences are reported to the responsible person of the management. The Company should have a system in place for recording, investigating, evaluating, reviewing and analysing such reports, and to take action as appropriate.

6.2 The system should ensure such reports are reviewed and evaluated by the responsible person(s) in order to determine appropriate corrective action and to ensure that recurrences are avoided. The evaluation of reports may result in:

.1 appropriate corrective actions;

.2 amendments to existing procedures and instructions; and

.3 development of new procedures and instructions.

6.3 The responsible person should properly monitor the follow-up and closing-out of the non-conformities/deficiency reports. The receipt of reports should be acknowledged to those persons who have raised the reports. This should include the status of the report and any decisions made.

6.4 The Company should encourage the reporting of near-misses to maintain and improve safety awareness (see MSC/Circ.1015). A near miss can be defined as hazardous situation where an accident was avoided. The reporting and analysis of such incidents are essential for an effective risk assessment by the Company, especially where accident information is not available.

## 7 INTERNAL AUDITS

7.1 Companies should carry out internal audits at least once per year to verify whether shore-based and shipboard activities comply with the SMS. These internal verifications should be prepared and conducted in accordance with procedures established by the Company. The procedures should at least consider the following elements:

.1 responsibilities;

.2 competence and selection of auditors;

.3 audit scheduling;

.4 preparing and planning the audit;

.5 executing the audit;

.6 audit report; and

.7 corrective action follow-up.

## 8 QUALIFICATIONS, TRAINING AND EXPERIENCE

8.1 The ISM Code requires the Company to ensure that all personnel involved in the Company's SMS have an adequate understanding of relevant rules, regulations, codes and guidelines. The Company should ensure that all personnel have the qualifications, training and experience that may be required in support of the SMS.

**Annex C**

IMO Guidance on near-miss reporting

**INTERNATIONAL MARITIME ORGANIZATION**
4 ALBERT EMBANKMENT
LONDON SE1 7SR

Telephone: 020 7735 7611
Fax: 020 7587 3210

**IMO**

***E***

Ref: T2-HES/4.2
T5-MEPC/1.01

MSC-MEPC.7/Circ.7
10 October 2008

# GUIDANCE ON NEAR-MISS REPORTING

1 The Maritime Safety Committee, at its eighty-fourth session (7 to 16 May 2008), and the Marine Environment Protection Committee, at its fifty-eighth session (6 to 10 October 2008), noted that the Maritime Safety Committee, at its seventy-fourth session (30 May to 8 June 2001), considered the issue of reporting near-misses and how to promote a no-blame culture and issued MSC/Circ.1015 to encourage reporting of near-misses.

2 The Committees further noted that guidance was required:

.1 to encourage reporting of near-misses so that remedial measures can be taken to avoid recurrences; and

.2 on the implementation of near-miss reporting in accordance with the requirements of section 9 of the ISM Code with respect to reporting of hazardous situations.

3 Accordingly, in order to encourage the reporting of near-miss occurrences and promote a safety culture, the Committees approved the guidance as set out in the annex.

4 Member Governments and international organizations concerned are recommended to bring this circular to the attention of all parties concerned.

***

**ANNEX**

**GUIDANCE ON NEAR-MISS REPORTING**

## 1 Introduction

1.1 Companies should investigate near-misses as a regulatory requirement under the "Hazardous Occurrences" part of the ISM Code. Aside from the fact that near-miss reporting is a requirement, it also makes good business and economic sense because it can improve vessel and crew performance and, in many cases, reduce costs. Investigating near-misses is an integral component of continuous improvement in safety management systems. This benefit can only be achieved when seafarers are assured that such reporting will not result in punitive measures. Learning the lessons from near-misses should help to improve safety performance since near-misses can share the same underlying causes as losses.

1.2 For a company to realize the fullest potential benefits of near-miss reporting, seafarers and onshore employees need to understand the definition of a near-miss to ensure that all near-misses are reported. The company also needs to be clear about how the person who reports the near-miss and those persons involved will be treated. The guidance that follows suggests that the company should encourage near-miss reporting and investigation by adopting a "just culture" approach.

1.3 A "just culture" features an atmosphere of responsible behaviour and trust whereby people are encouraged to provide essential safety-related information without fear of retribution. However, a distinction is drawn between acceptable and unacceptable behaviour. Unacceptable behaviour will not necessarily receive a guarantee that a person will not face consequences.

1.4 It is a crucial requirement that the company clearly defines the circumstances in which it will guarantee a non-punitive outcome and confidentiality. The company should provide training and information about its approach to "just culture" near-miss reporting and investigation for all persons involved.

## 2 Defining near-miss

2.1 Near-miss: A sequence of events and/or conditions that could have resulted in loss. This loss was prevented only by a fortuitous break in the chain of events and/or conditions. The potential loss could be human injury, environmental damage, or negative business impact (e.g., repair or replacement costs, scheduling delays, contract violations, loss of reputation).

2.2 Some general examples of a near-miss help to illustrate this definition:

.1 Any event that leads to the implementation of an emergency procedure, plan or response and thus prevents a loss. For example, a collision is narrowly avoided; or a crew member double checks a valve and discovers a wrong pressure reading on the supply side.

.2 Any event where an unexpected condition could lead to an adverse consequence, but which does not occur. For example, a person moves from a location immediately before a crane unexpectedly drops a load of cargo there; or a ship finds itself off-course in normally shallow waters but does not ground because of an unusual high-spring tide.

.3 Any dangerous or hazardous situation or condition that is not discovered until after the danger has passed. For example, a vessel safely departs a port of call and discovers several hours into the voyage that the ship's radio was not tuned to the Harbour Master's radio frequency; or it is discovered that ECDIS display's scale does not match the scale, projection, or orientation of the chart and radar images.

## 3 Overcoming barriers to reporting near-misses

3.1 There are many barriers related to the reporting of near-misses. In many cases, near-misses are only known by the individual(s) involved who chose to report or not report the incident. Some of the main barriers to the reporting of near-misses include the fear of being blamed, disciplined, embarrassed, or found legally liable. These are more prevalent in an organization that has a blame-oriented culture. Amongst other barriers are unsupportive company management attitudes such as complacency about known deficiencies; insincerity about addressing safety issues and discouragement of the reporting of near-misses by demanding that seafarers conduct investigations in their own time.

3.2 These barriers can be overcome by management initiatives such as:

.1 Encouraging a "just-culture" in the company which covers near-miss reporting.

.2 Assuring confidentiality for reporting near-misses, both through company policy and by "sanitizing" analyses and reports so that personal information (information identifying an individual) of persons associated with a near-miss is removed and remain confidential. Personal information should not be retained once the investigation and reporting processes are complete.

.3 Ensuring that investigations are adequately resourced.

.4 Following through on the near-miss report suggestions and recommendations. Once a decision has been made to implement, or not implement, the report's recommendations should be disseminated widely.

## 4 The near-miss investigation process

4.1 As a minimum, the following information should be gathered about any near-miss:

.1 Who and what was involved?

.2 What happened, where, when, and in what sequence?

.3 What were the potential losses and their potential severity?

.4 What was the likelihood of a loss being realized?

.5 What is the likelihood of a recurrence of the chain of events and/or conditions that led to the near-miss?

4.2 The answer to these questions will determine if an in-depth investigation is needed, or if a cursory report will suffice. An in-depth investigation is required of those near-misses which are likely to recur and/or which could have had severe consequences.

4.3 Once a decision has been taken to proceed with a full investigation, further decisions are taken about levels of staffing required, who should be responsible, and what resources are required for the investigation to be completed successfully. The main steps in the investigation are:

***Gathering near-miss information***

4.4 Regardless of the nature of the near-miss, the basic categories of data that should be gathered include: people, paper documents, electronic data, physical, and position/location. These data are vital for ensuring that an understanding can be reached about what, how, who, and eventually why the near-miss occurred. Data gathering is done by interviews of key personnel and the collection of physical, position and location data, using such things as photographs, VDR recordings, charts, logs, or any damaged components. Furthermore, information should be gathered regarding safeguards in place to protect the persons on board and the public, and the operational systems impacting the near-miss event.

***Analysing information***

4.5 Applying data analysis techniques helps to identify information that still needs to be collected to resolve open questions about the near-miss and its causes. This can make the collection of additional data more efficient. The end goal of this activity is to identify all causal factors.

***Identifying causal factors***

4.6 At this point the who, what, where, why, and when of the near-miss is understood, and the human errors, structural/machinery/equipment/outfitting problems, and external factors that led to the near-miss, have been identified. The next step is to better understand the causal factors that contributed to the near-miss. There are a variety of identification methods for this purpose, including taxonomies of causes. These can be used for deep probing past the most evident causes.

***Developing and implementing recommendations***

4.7 Any recommendations made need to address all of the identified causal factors to improve organizational and shipboard policies, practices and procedures. Implementing appropriate recommendations is the key to eliminating or reducing the potential for the reoccurrence of similar near-misses or more serious losses.

## 5 Completing the investigation

5.1 Completion of the investigation process requires the generation of a report (either brief or extensive, depending on the depth of analysis performed and the extent of risk), and collating and storing the information in a way that supports subsequent (long term) trend analysis.

5.2 The ultimate objective of near-miss reporting and investigating is to identify areas of concern and implement appropriate corrective actions to avoid future losses. To do so requires that reports are to be generated, shared, read, and acted upon. Companies are encouraged to consider whether their report should be disseminated to a wider audience.

5.3 It may take years for safety trends to be discerned, and so reporting must be archived and revisited on a timely basis. Near-miss reports should be considered along with actual casualty or incident reports to determine trends. There should be consistency in the identification and nomenclature of causal factors across near-miss and casualty/incident reports.

**Annex D**

International Shipping Federation - safety culture leaflet

Issued by the International Shipping Federation

ISF SPECIAL

# Safety Culture

See back page: HOW CAN COMPANIES CHECK IF THEY ARE LOSING MONEY?

## Safety culture is enlightened self interest

Safety culture is of interest to all senior decision makers in shipping companies, not only those with direct involvement in the day to day technical operation of their companies' ships, because improving safety saves money as well as lives.

In addition to ethical and social responsibilities, shipping companies practise a safety culture because:

- **Senior managers that cannot manage safety will be unlikely to manage a profitable shipping company**
- **A dedicated approach to safety is a cost saving not a cost**
- **Safety culture provides a means of maximising the benefits and cost savings that can be derived from implementing the ISM Code.**

## HOW CAN A SAFETY CULTURE SAVE MONEY?

The following benefits have been derived by shipping companies from the conscious attempt to practise a safety culture:

- **reduction in lost employee hours**
- **reduction in hospital costs**
- **reduction in sick leave**
- **reduction in pollution costs**
- **reduction in cargo damage**
- **reduction in insurance premiums**

*"The **indirect** costs of maritime accidents are estimated to be around **3 times** the direct costs associated with injuries, deaths, property damage and oil spills."*

## FOCUS ON SAFETY CULTURE

**Regulators, classification societies, the maritime press and IMO constantly refer to the need for ship operators to practise a safety culture. But what precisely do they mean?**

Everyone agrees with the objectives of a safety culture - the reduction and elimination of accidents which involve injuries to ships' personnel and damage to property and the environment — but there can be some confusion as to what a safety culture really represents.

Experts commonly describe it as the values and practices that management and personnel share to ensure that risks are minimised and mitigated to the greatest degree possible. In short, this means that safety is always the first priority.

With a true safety culture, every crew member - whether a rating or a master - thinks about safety, and new ways of improving it, as matter of course.

The cause of practically every unsafe incident can be traced to some form of human or organisational error. If people think about safety continuously, many accidents simply will not happen because virtually all so called "accidents" are in fact preventable.

The development of a safety culture does not lend itself to prescriptive rules, and the purpose of this leaflet is simply to encourage key people in shipping to consider how even more might be done to improve levels of maritime safety.

Although experts on the subject may talk in terms of psychology or behavioural change, the key to achieving a safety culture is:

- **Recognising that all "accidents" are preventable and normally only occur following unsafe actions or a failure to follow correct procedures**
- **Constantly thinking safety and**
- **Always setting targets for continuous improvement.**

# SO WHAT IS A SAFETY CULTURE?

**There is nothing inherently new about the concept of a safety culture. The term simply embraces what the majority of reputable ship operators have recognised for years - that safety is a priority and that it has to be managed efficiently and systematically like any other part of the business.**

As long ago as 1981, and with no claims to originality, ICS and ISF published their Code of Good Management Practice which advocated a "culture of self regulation of safety". The ISM Code is to a large extent derived from the ICS/ISF Code of Practice, reflecting the development of the industry's understanding of safety management, in line with the emphasis in safety culture on constant improvement.

Safety management is a complex subject and shipping companies can always benefit from the continuing research that has been undertaken in this area. But it is important to recognise that safety culture should not necessarily be seen as something radically different from what many shipping companies are doing already.

# Safety in shipping: the industry's improving record

Merchant shipping is arguably the safest and most environmentally benign form of transport. Perhaps uniquely amongst industries involving physical risk, commitment to safety has long pervaded virtually all deep sea shipping operations. Shipping was amongst the very first industries to adopt widely implemented international safety standards.

A range of different measures appears to indicate that the safety record of shipping has shown a continuous improvement in recent years, despite a substantial increase in the size of the world fleet.

Research by the International Underwriting Association (which represents hull insurers) suggests that there has been a trend of steady reduction in total losses of ships during the 1990s. This reduction is even more marked when shown in terms of losses to the proportion of ships afloat (see figures 1&2).

The number of third party liability claims resulting from shipping accidents, including personal injury claims, also appears to have decreased during the 1990s. According to the UK P&I Club (the largest maritime third party liability insurer), the number of received claims (after adjustments to take account of changes to the number of ships entered in the Club) reduced from 18,000 in 1990 to about 12,000 in 1996 (see figure 3). A similar improvement is revealed in respect of the number of large claims over US $100,000 (see figure 4).

The improved safety record of shipping is further supported by its environmental record. Estimates of the quantity of oil spilled by shipping reduced from 384,000 tonnes in 1983 to only 10,000 tonnes in 1998. 1998 may have been an exceptional year, but the overall trend (figure 5) is clear.

While technological development plays a part in these encouraging figures, it is generally accepted that the main contributor is increased safety awareness amongst management and employees. But the underlying concept of a true safety culture is that there is always room for further improvement.

**Figure 1: Total losses by number** *Ships over 500 gt*

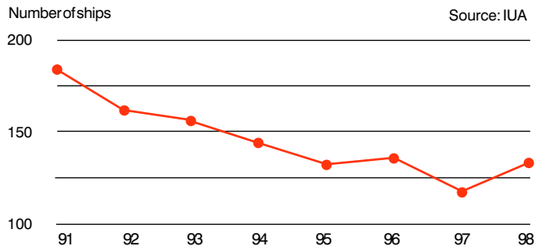



**Figure 2: Total losses (by number of ships) in proportion to shipping afloat** *Ships over 500 gt*

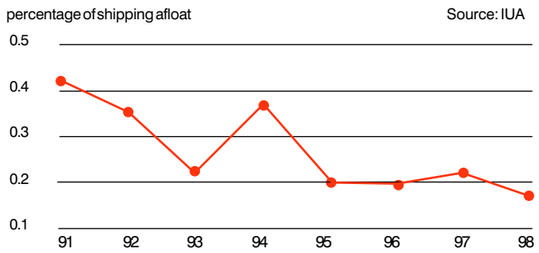



**Figure 3: All claims — frequency**

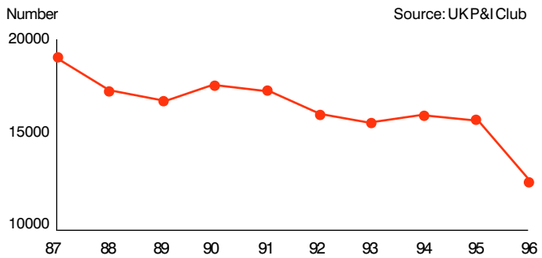



**Figure 4: Major claims — frequency**

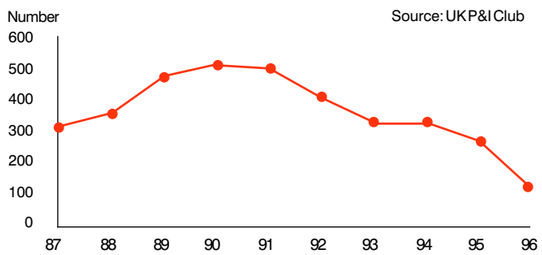
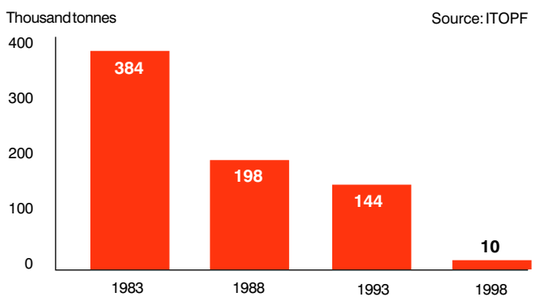



**Figure 5: Quantity of spilled oil, tonnes**




# Implementing a Safety Culture

There are perhaps three components to introducing a genuine safety culture:

1. **Commitment from the top**
2. **Measuring the scale of the problem**
3. **Changing behaviour.**

## 1. Commitment from the top

If company personnel are to act safely at all times, commitment from the highest level of the company is vital. Regardless of the ability and motivation of the operational managers with day to day responsibility for safety, if commitment from top-ranking decision makers is lacking then the efforts of everyone else will invariably be wasted. However, in order to develop this commitment at the senior level, it is necessary for senior decision makers to have a proper understanding of the true costs of accidents.

Accountants may be prone to question why safety should be the first priority if compensation for accidents is met by insurance. But accidents imply a lack of reliability, and a lack of reliability will soon lose customers. A safety conscious company is an efficent company and efficency brings its own rewards. To foster a safety culture is a matter of enlightened self interest.

## 2. Measuring the scale of the problem

Crucial to achieving a genuine safety culture is having the means to monitor the company's current performance in order to identify ways in which safety can be continuously improved. Across all industries, the most widely used form of monitoring the effectiveness of current policies is the use of the Lost Time Accident (LTA) rate*. An LTA is an incident which results in absence from work beyond the day or shift when it occurred. The LTA rate is usually calculated as the number of LTAs that occur during 100,000 working hours.

Research has demonstrated that if the number of personnel accidents is reduced then the number of other accidents, such as those involving damage to property, will also be reduced. The goal of a true safety culture is to reduce the LTA rate to zero, and companies regarded as being at the cutting edge of safety culture claim to achieve negligible LTA rates.

There are a number of other means of monitoring safety performance which may include making distinctions between serious injuries and minor ones, or which may be derived from statutory reporting requirements contained in national legislation. The key point, however, is that companies employ some means of monitoring their safety performance over time.

Many companies find it useful to compare their safety records with those of other companies or industries. The major oil companies (i.e. those that belong to the Oil Companies International Marine Forum), for example, compare their safety statistics on an agreed basis, as do the operators of offshore support vessels that belong to International Support Vessel Owners' Association. It is recognised that conditions existing in different trades cannot be readily compared, but it can be productive to conclude informal arrangements to exchange information and experience with companies operating in broadly similar circumstances.

## 3. Changing behaviour

The key aspect of a safety culture is changing the behaviour of seafarers and shore based managers so that they believe in safety, think safely and always seek further improvements.

The introduction of a genuine safety culture based on the concept of continual improvement, and personal commitment and responsibility on the part of everyone in the company, is a long term process and involves a lot of hard work. To a certain extent, experience gained through the introduction of Safety Management Systems required by the ISM Code should result in a change in behaviour. It should be recognised, however, that companies can take additional steps to encourage the change from a culture of compliance with regulations to that of a culture based on individual commitment to safety.

At one extreme, companies may wish to conduct detailed "behavioural assessment" programmes, using outside expertise, in order to work out the best way to move forward. The assistance of outside consultants may then be used to oversee the change to the company's safety culture. For many companies, however, a less ambitious approach may be more appropriate.

A starting point is making sure that employees fully understand why they are following the procedures required by adherence to the ISM safety management system. They need to understand that the purpose is not simply to satisfy ISM Code auditors but to bring about actual improvements in safety.

Additional advice on accident prevention, and the introduction of safety culture, is available from P&I Clubs, classification societies, national maritime administrations and national shipowners' associations. The most important thing for companies to recognise, however, is that changing behaviour is a continuous and deliberate process. This requires the full commitment of senior management, which includes making the necessary financial resources available.

**Also known as the Loss Time Injury or Lost Time Incident rate.*

## INSURANCE DOES NOT BLIND SAFETY CONSCIOUS SHIPPING COMPANIES TO THE TRUE COST OF ACCIDENTS

**Example**

A container is dropped on deck during loading. Due to failure to follow an agreed procedure the incident is not reported because the officer thinks no damage has been done to the container. It is subsequently found that a fuel tank beneath the deck has been ruptured spoiling the contents of 30 boxes.

**The total cost to the ship operator of this incident (unrecoverable from insurance) could typically be $200,000** – *repairs* $50,000*, *30 containers* $30,000*, *delay* $55,000, *rescheduling* $50,000, *management time* $15,000.

* Assuming P&I deductibles: hull and machinery $100,000, containers $1,000 per box

## The Safety Triangle

If 30 LTAs are prevented a life will probably be saved!

**1 Major Injury (LTA)**
**30 Minor Injuries**
**330 Unsafe Acts or Actions**

Research has shown that for approximately every 330 unsafe acts, 30 are likely to result in minor injury. Of these 30 minor injuries, one is likely to be an LTA with a cost implication for the company. Thus every time 300 unsafe acts are prevented an LTA is likely to be prevented. More to the point, however, statistics have shown that if 30 LTAs are prevented a life will probably be saved!



www.marisec.org

## How can companies check if they are losing money?

**A simple check on whether or not a shipping company may be losing money unnecessarily is to see if the company's operational managers can provide senior managers with the following information:**

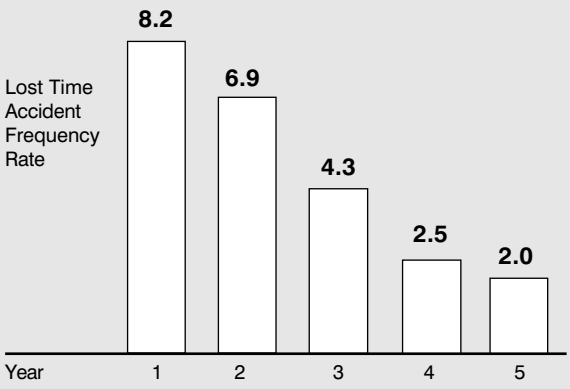
- How many "Lost Time Accidents" did the company's crew members have last year and was this better or worse than the year before?
- What proportion of the company's personal accidents were caused by a simple failure to follow established procedures, i.e. were totally avoidable and should never be repeated?
- How does the accident record of the company compare with that of its competitors? Is the company capable of finding out?
- What proportion of last year's costs resulting from accidents were not repaid by insurance and were in fact covered by the company directly?

If operations managers appear unable to answer any of these questions satisfactorily, it is possible that the company may be losing money unnecessarily and that there is more that might be done to encourage the practice of a safety culture.

Introducing radical improvements to a company's safety culture cannot be achieved overnight, but the first stage, and the key to success, is commitment from the most senior level of management including managing directors, finance directors and everyone else at boardroom level.

The full benefits of a commitment to implement a total safety culture may take four or five years to materialise, but experience has shown that real results can be achieved within as little as one or two years.

**Implementing a safety culture - the experience of a multinational shipping company**




*ISF is the international employers' organisation for shipowners, concerned with labour affairs, manpower and training issues.*

**International Shipping Federation**
12 Carthusian Street London EC1M 6EZ
Tel: +44 20 7417 8844
Fax: +44 20 7417 8877
E-mail isf@marisec.org
Web site: www.marisec.org

# Using safety culture to get the best from ISM

**Safety culture, of course, is closely linked to the philosophy underlying the IMO International Safety Management (ISM) Code.**

If a company successfully implements ISM this should encourage positive changes of behaviour with regard to safety management. Indeed, the proper implementation of the ISM Code should result in a safety culture.

But there can be a difference between complying with the letter of the ISM Code and fulfilling its spirit, i.e. the conscious practice of an attitude to safety in which all accidents are seen as preventable, and everything reasonably possible is done to ensure that accidents are actually prevented.

The achievement of a total safety culture goes beyond compliance with the ISM Code since it can provide a means of maximising the benefits and cost savings that can be derived from the systems which ISM requires companies to implement.

Seafarers and their managers may be compelled, by legislation, to follow certain procedures. But people cannot be compelled to believe in these procedures or to think about the safety implications of everything that they are doing.

The public focus of the ISM Code has been on the need for companies to comply with it within specified deadlines, and to be issued with Documents of Compliance and Safety Management Certificates. However, the underlying purpose of the ISM Code is to move shipping away from a culture of "unthinking" compliance with external rules towards a culture of "thinking" self regulation of safety.

Following the spirit of the ISM Code involves, not least, a commitment to continuous improvement of the company's safety record. However, safety culture involves moving beyond compliance with external rules to a culture of self regulation, with every individual - from the top to the bottom - feeling responsible for actions taken to improve safety, rather than seeing them as being imposed from the outside.

## Acknowledgements

*The contents of this leaflet were developed with the help of an Accident Prevention Working Group established by the ISF Manning and Training Committee. The members of the Group gave their advice in a personal capacity and their contribution is gratefully acknowledged.*

**ISF Accident Prevention Working Group**

Chairman: Nils Telle (Norwegian Shipowners' Association)
Captain Kurt Rye Damkjaer (previously Danish Maritime Institute)
Captain Simon Kembury (V Ships)
Captain Malcolm Lowle (Shell)
Karl Lumbers (UK P&I Club)
John Millican (Warsash Maritime Training Centre)
Julian Parker (Nautical Institute)
Mike Stubbings (previously UK Chamber of Shipping)
Mark Williams (West of England P&I Club)

Published by Maritime International Secretariat Services Ltd. (Marisec)
12 Carthusian Street, London EC1M 6EZ

MAIB Safety Digest 1/2007, case 15

# Smoking Kills!

## Narrative

After a short trip fishing for scallops, an under 10m fishing vessel returned to port around midday and moored outboard of another fishing vessel in port. The skipper and crewman spent some time sorting out the boat before going to a local pub.

In the early evening, the skipper left the crewman at the pub and went home to prepare for his evening job, working at a night club. During the evening, the crewman continued drinking, and at 0200 went to the club where the skipper was working. Both men were given a lift from the club at about 0430; the skipper went home, and the crewman returned to the fishing vessel as his usual shore accommodation was unavailable.

The crewman managed to climb down the quayside ladder and cross the boat alongside to his own fishing vessel where, using a spare key hidden on the boat, he entered the wheelhouse. He did not turn on any lights, leaving the vessel's main batteries isolated, but picked up the wheelhouse ashtray and descended into the small accommodation space in the dark. There, he partially undressed and sat on one of the bunks to smoke a cigarette.

As he smoked, the crewman either fell asleep or became unconscious, and his cigarette started a smouldering fire which burnt a small amount of the bunk's foam mattress and woodwork (see photograph). The crewman died without regaining consciousness as the fire consumed the oxygen in the space and gave off toxic fumes.

The owner boarded the fishing vessel later that morning, and smelt smoke as he opened the wheelhouse door. Taking the wheelhouse fire extinguisher, he first checked the engine room for fire before returning to the wheelhouse and entering the accommodation space. He found the crewman in the smoke-filled accommodation space. There were no flames, the fire having burnt itself out during the night.

## The Lessons

1. **Neither the owner nor the skipper permitted smoking in the accommodation space, for good reason. However, perhaps due to the influence of alcohol, the crewman forgot this policy and paid the ultimate price.**

2. **A smoke alarm might well have prevented this tragic accident. A simple domestic fire alarm costs very little and merely requires a new battery periodically. Fitting a smoke alarm is easy, and it may well save you or your crew's life. It is intended that a smoke alarm will be required on all decked vessels covered by the revised Small Fishing Vessel Code to be issued in the future.**

3. **Where possible, use non-combustible materials on board your vessel, or materials which are resistant to ignition. They will reduce the chances of a fire starting, or, if one does start, will help prevent it spreading quickly.**

Marine Accident Report